Programmes After Market Services
TME-3 Series Transceivers

Disassembly and Troubleshooting

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Introduction to troubleshooting

The first thing to do is carry out a through visual check of the module. Ensure in particular that:

a) there are not any mechanical damages

b) soldered joints are OK

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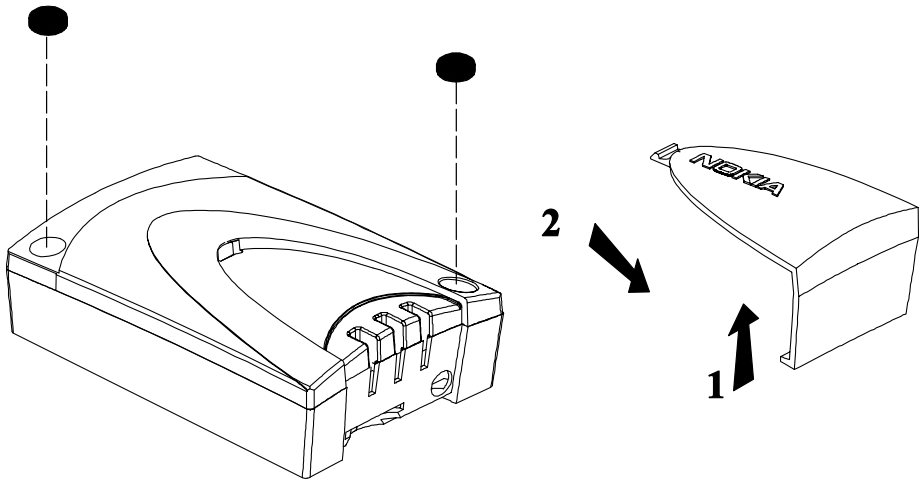
Disassembly of TME-3

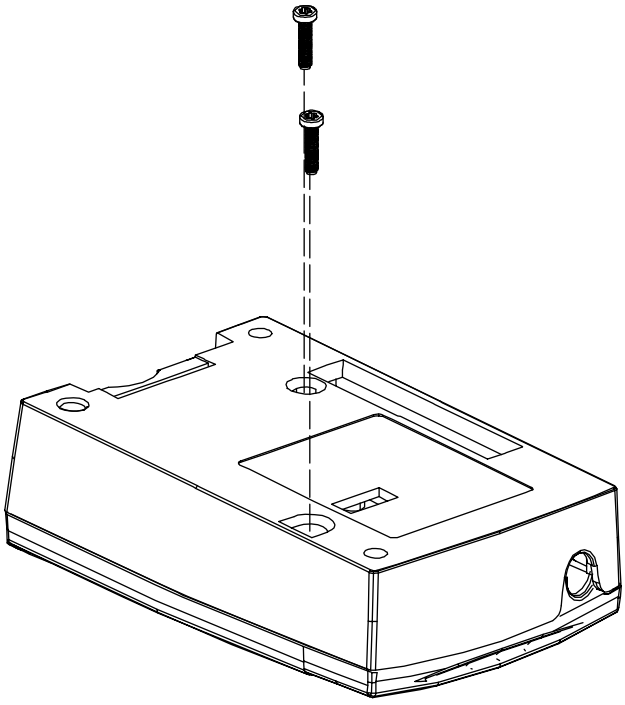
1. Remove the lens.

Figure 1: Lens removal



2. Turn the device upside down and remove the two screws.

Figure 2: screw removal 1



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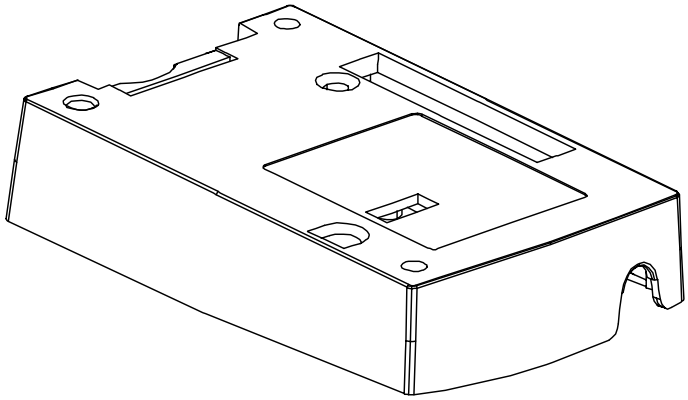
3. Remove the B cover.

Figure 3: Remove the B-cover.



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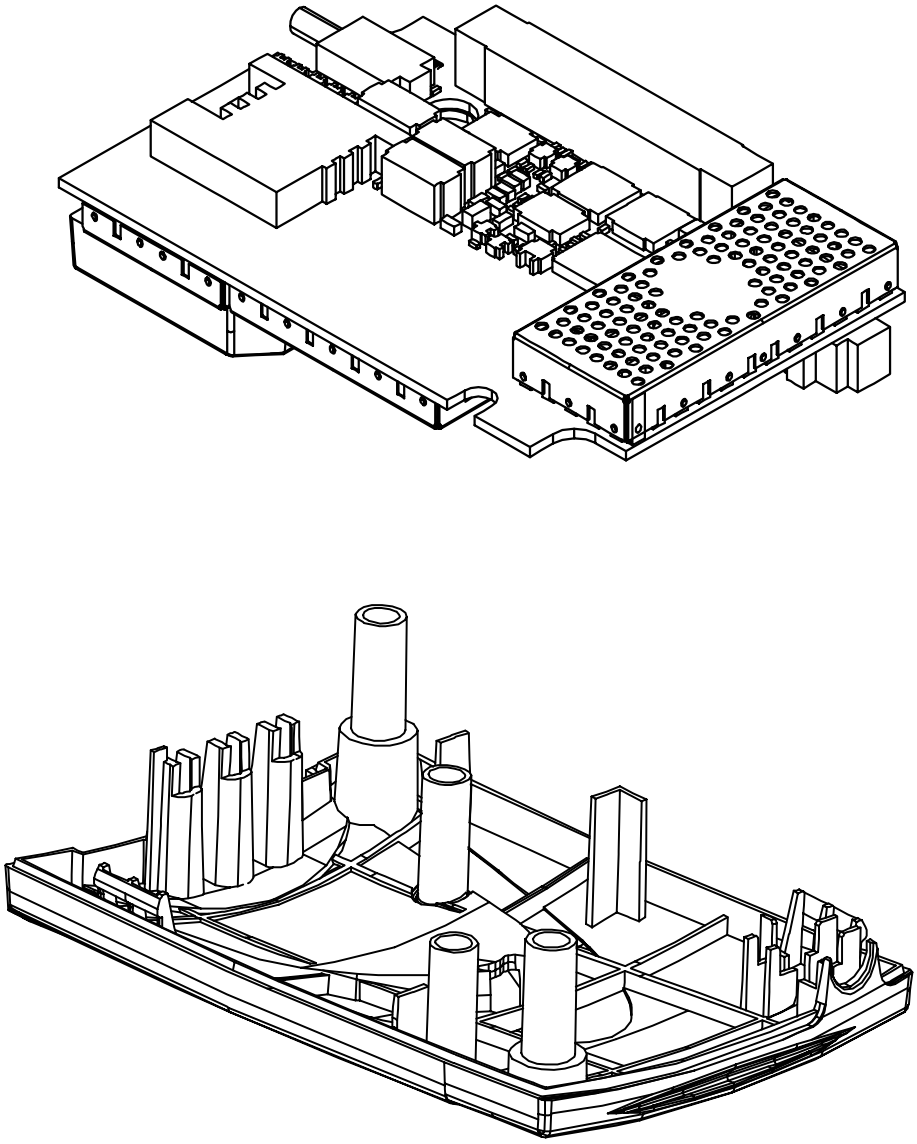
4. Remove the data module from the A-cover

Figure 4: B-cover removed



NOTE: The screws require Torx6 screwdriver tip. Thecorrect tightening torque is 25Ncm.

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RF Troubleshooting

Introduction to RF troubleshooting

The RF-section of the RL7 module is build around one RF-ASIC (HAGAR, N600). For easier troubleshooting, the instructions are divided into three sections: transmitter, receiver and synthesizer.

Component notes:

Apart from key components described in this document here are several discrete components (resistors, inductors and capacitors), the troubleshooting of which is done by checking whether the soldering of each component is OK.

Capacitors can be checked for short circuits and resistors for value by means of an ohmmeter, but be aware that in-circuit measurements must be evaluated carefully.

Before replacing HAGAR, please check following: are the supply voltages and serial communication signals (coming from baseband to HAGAR) correct?

Please note that the grounding of the PA module is directly below the PA-module so it is difficult to check or change.

Component handling:

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (use ground straps and ESD soldering irons).

HAGAR and PA are moisture sensitive components; parts must be pre-baked prior to soldering.

Measurement notes:

Measurements must be done using spectrum analyzer with high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels) and oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

Please be aware that all measured voltages or RF levels in this document are rough figures. Especially RF levels vary due to different measuring equipment or different grounding of the used probe. When using RF probe usually a good way is to use metallic tweezers to connect probe ground to PWB ground as close to measurement point as possible.

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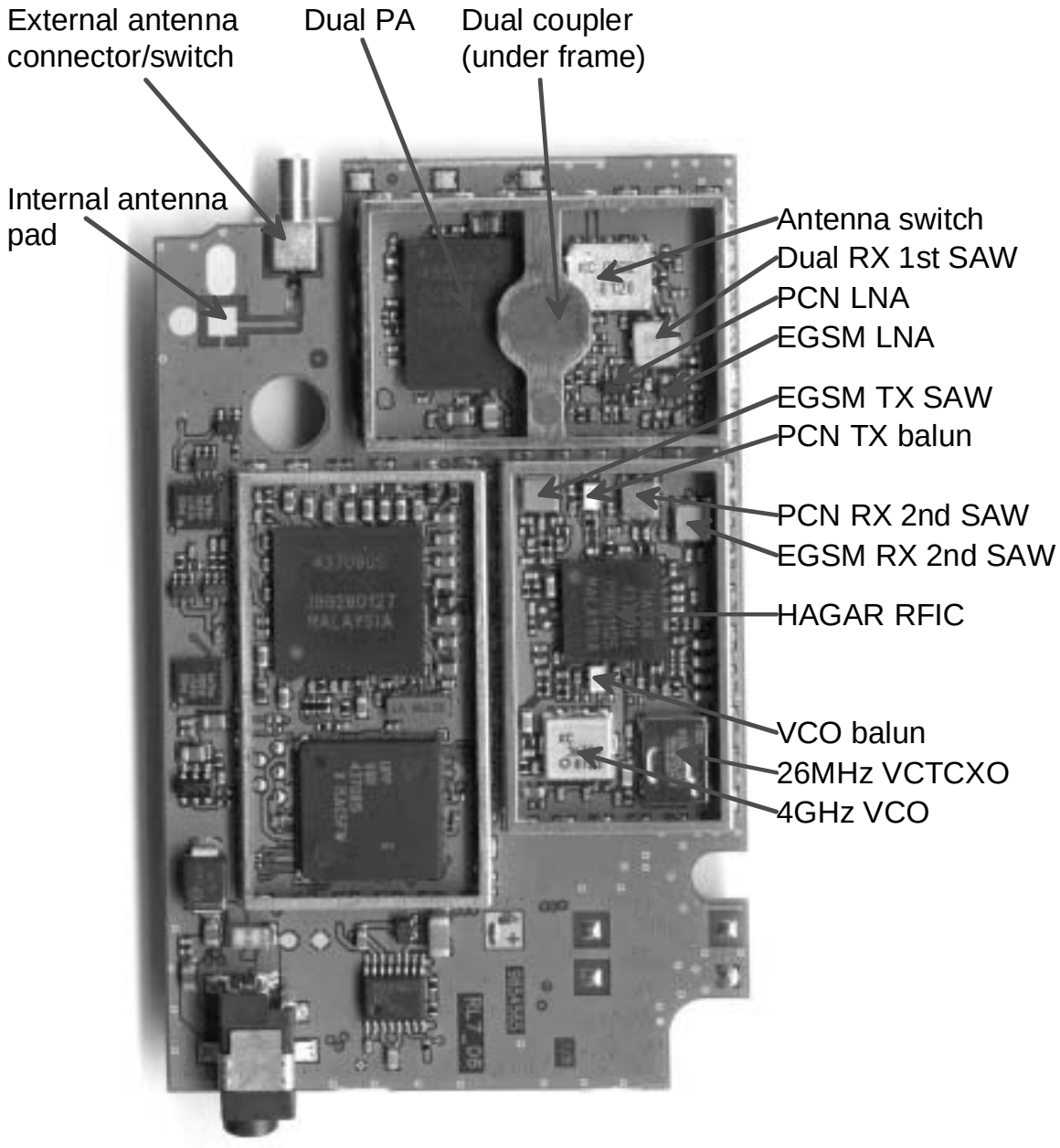
RF Key component placement

Figure 5: RL7 module component placement 1



NOTE! You can remove (cut) the frame above the power amplifier, ex. PA exchange

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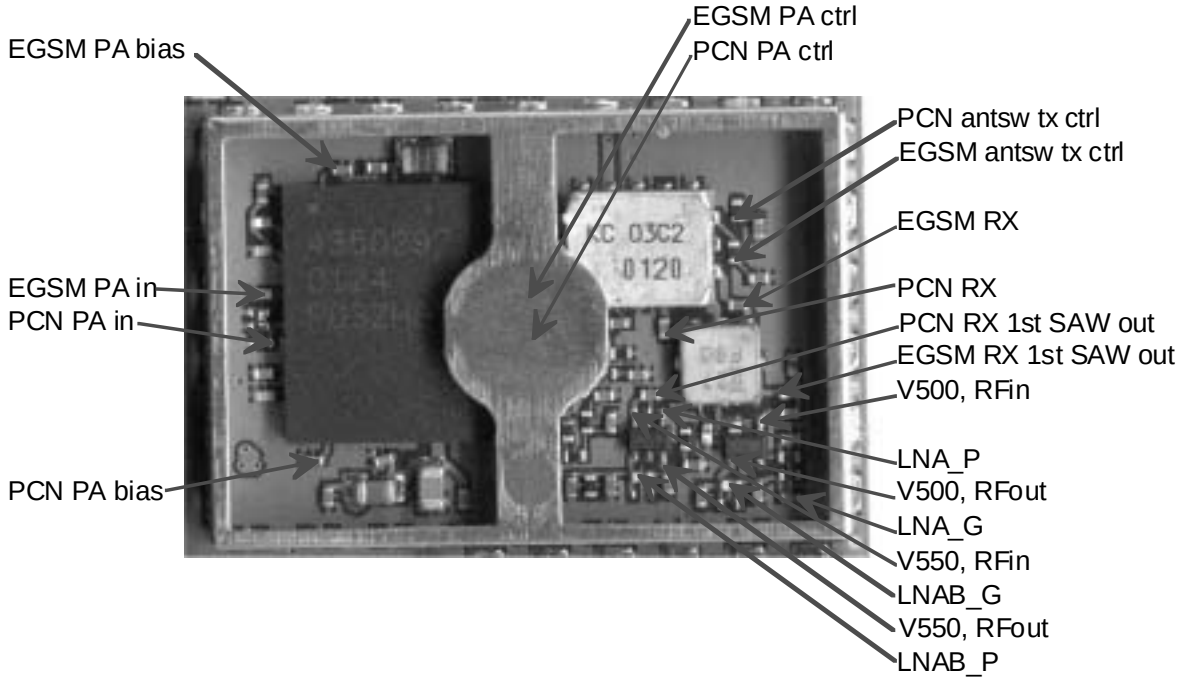
RF Measurement points

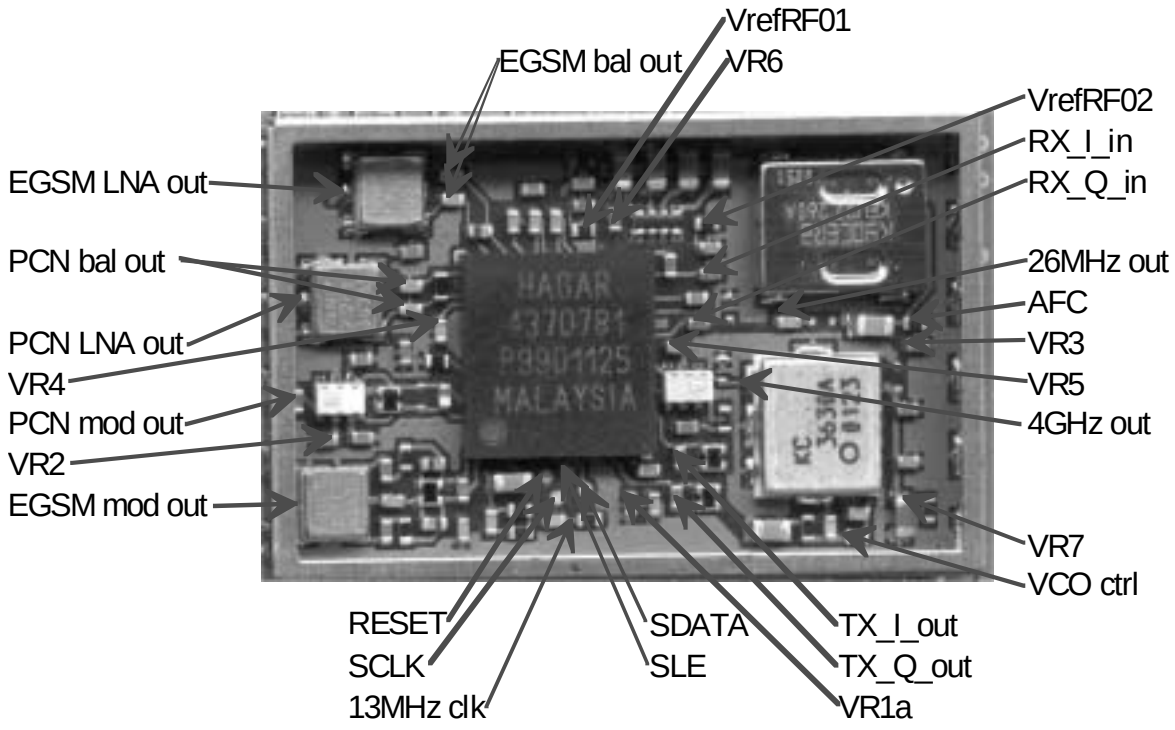
PA environment

Figure 6: Measurement points, PA 1/2



HAGAR environment below:

Figure 7: Measurement points, PA 2/2



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GSM900 & GSM1800 Transmitter

General instructions for Transmitter (Tx) troubleshooting

Connect the test jig to the PC with the DAU-9S cable or to the FPS-8 Flash Prommer with a XCS-4 modular cable.

Make sure that you have the PKD-1 dongle connected to the PCs parallel port.

Connect DC power supply to module test jig with a suitable cable.

Attention: When repairing or tuning transmitter use external DC supply with at least 3A current capability. Set the DC supply voltage to 13.5V.

Connect a RF- test cable (K-1888) to the external antenna connector and to measurement equipment or at least 10dB attenuator, otherwise the PA may be damaged.

Normally Spectrum analyzer is used as measurement equipment. Another way is connect RF-cable to the module test jig (MJS-46) RF connector to and to measurement equipment or at least 10dB attenuator.

NOTE: Normally a Spectrum analyzer maximum input power is +30dBm. A 10dB attenuator on Spectrum analyzer input must be used to prevent damage

Set the module in the test jig and start Phoenix service software.

Initialize connection to phone. (use FBUS driver when using DAU9S and COMBOX driver when using FPS-8).

Select product from the menu.

File -> Choose product -> TME-3

From toolbar set operating mode to "Local"

Activate RF controls window from the menu

Maintenance -> Testing -> RF Controls

From the RF controls window

- Select band "GSM900" or "GSM 1800" (Default = "GSM900")
- Set Active unit to "Tx" (Default = "Rx")
- Set Operation mode to "Burst" (Default = "Burst")
- Set Tx data type to "Random" (Default = "All1")

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- Set Rx/Tx channel to 37 on GSM900 band or 700 on GSM1800 band (Defaults)

- Set Tx PA mode to "Free" (Default)

- Set power level to 5 (Default = 19) on GSM900 or to 0 (Default = 15) on GSM1800

For transmitter schematics refer to the A3 size diagrams at the end of the manual.

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Transmitter troubleshooting diagrams

Figure 8: Tx troubleshooting

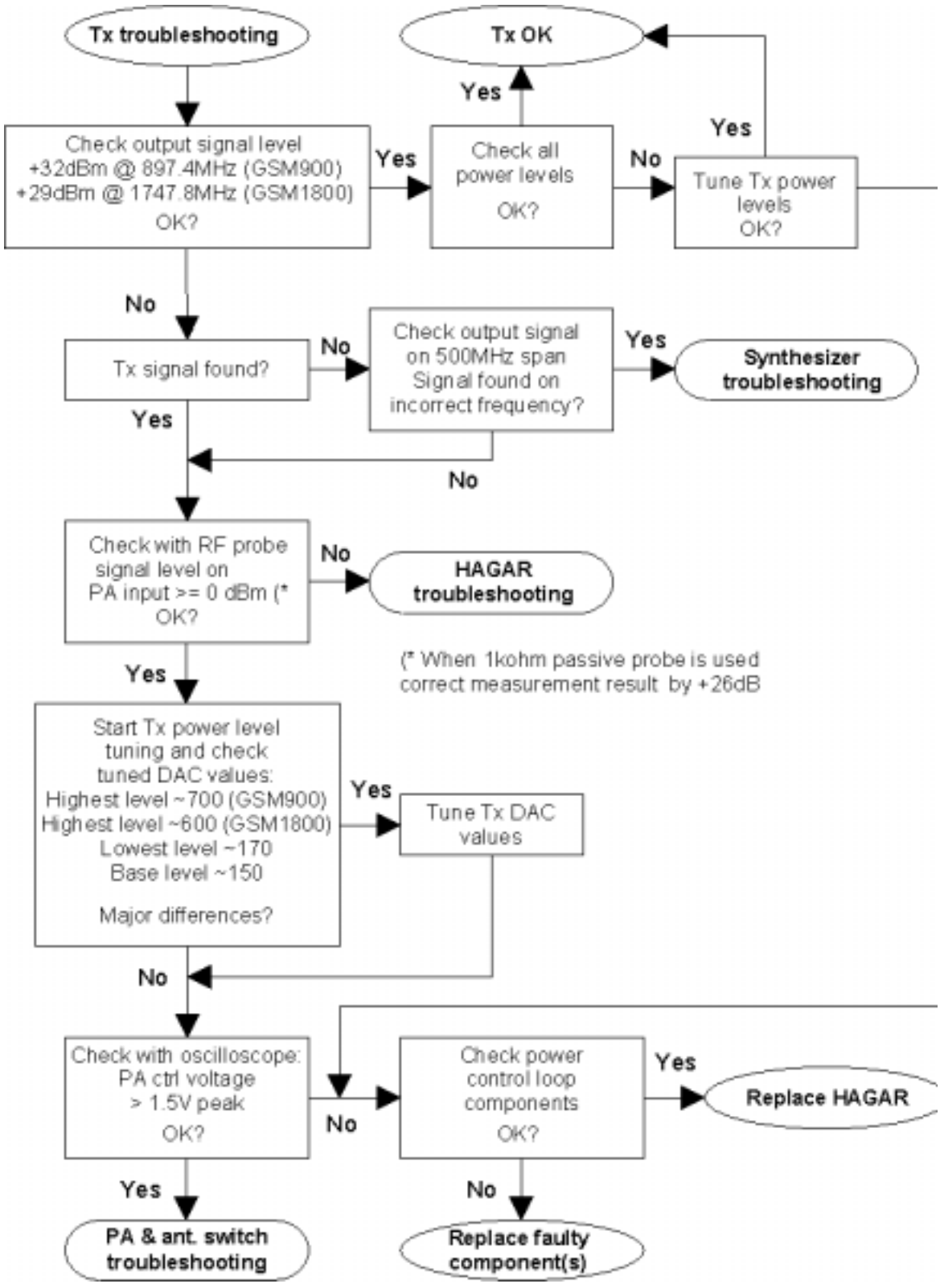

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Figure 9: Hagar Troubleshooting diagram

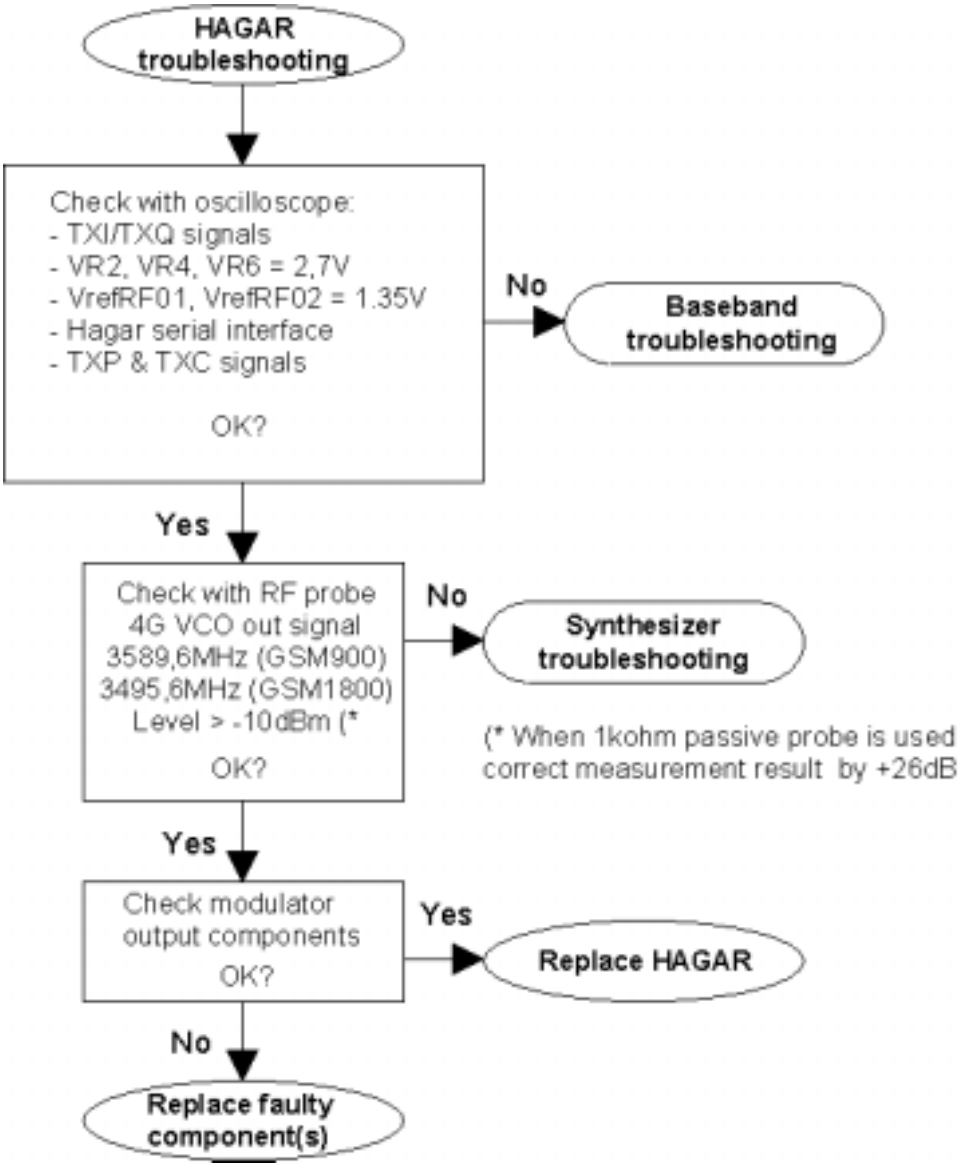

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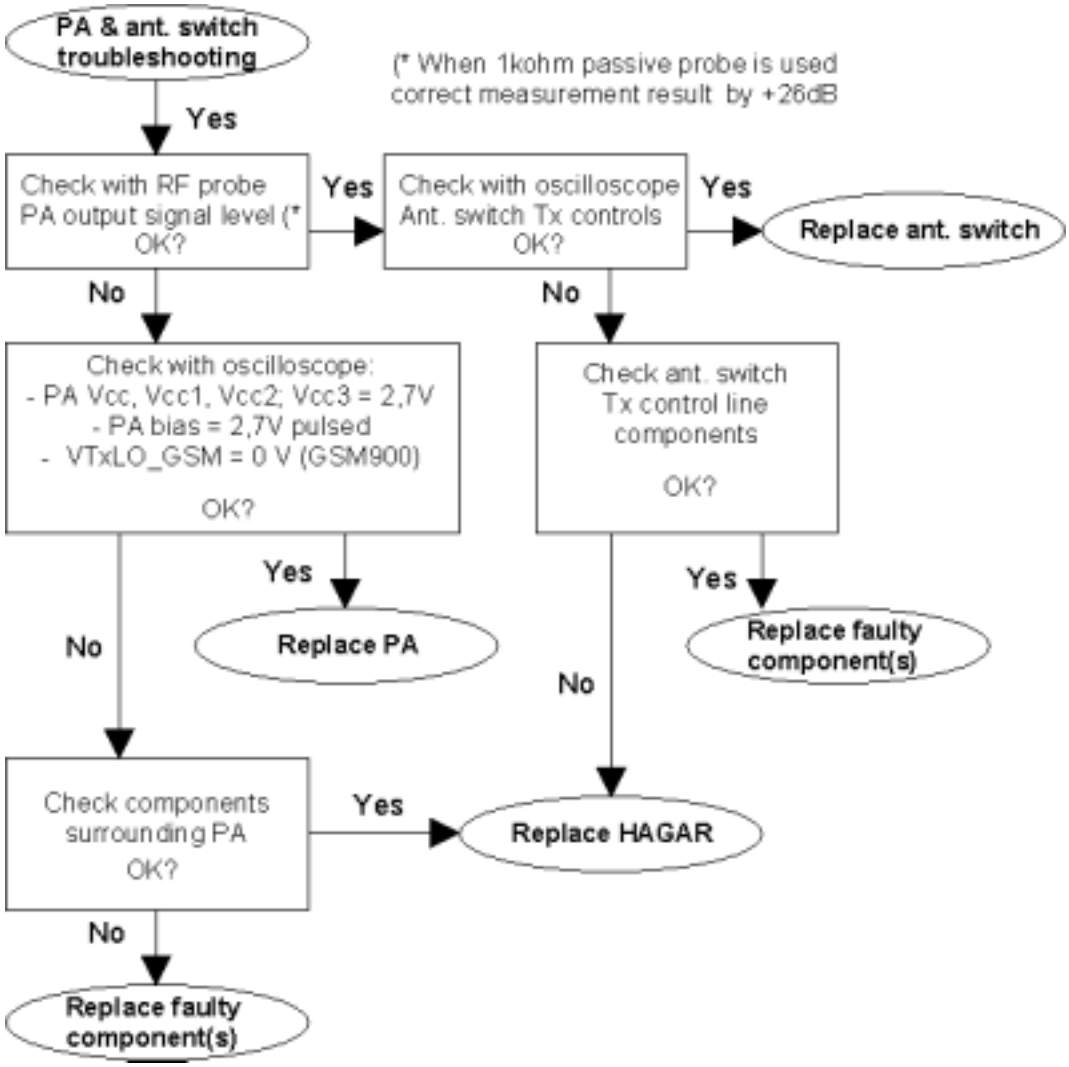
Figure 10: PA&Ant troubleshooting diagram



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Oscilloscope screen shots of transmitter signals

Figure 11: TXI_0, Tx on, Random data, Burst mode

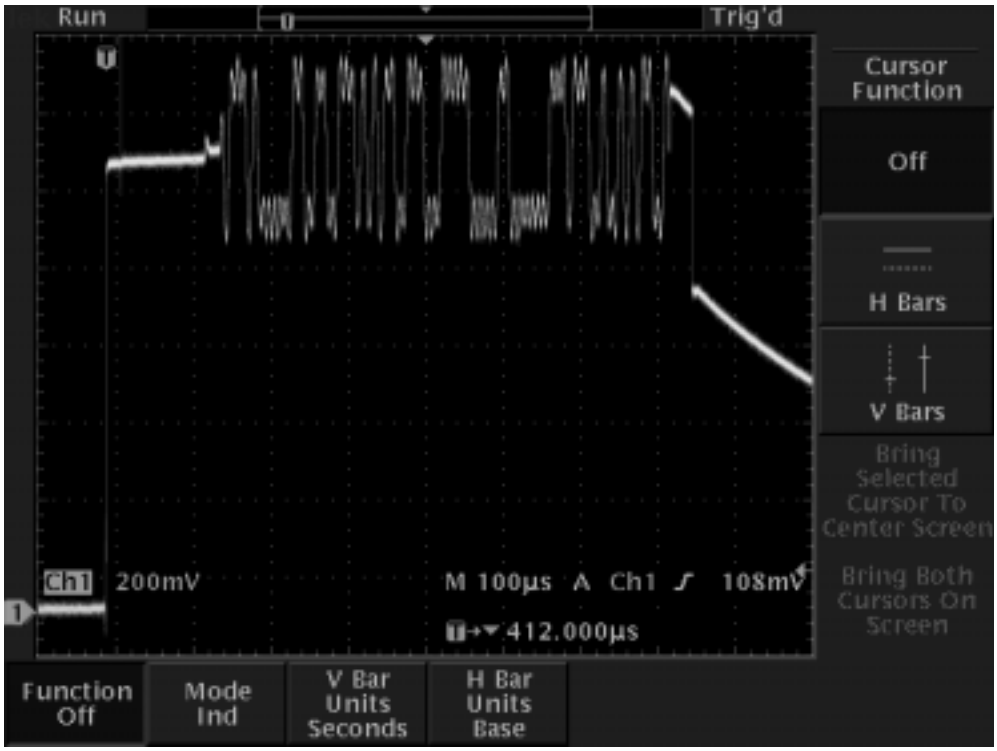

Figure 12: TXQ_0, Tx on, Random data, Burst mode

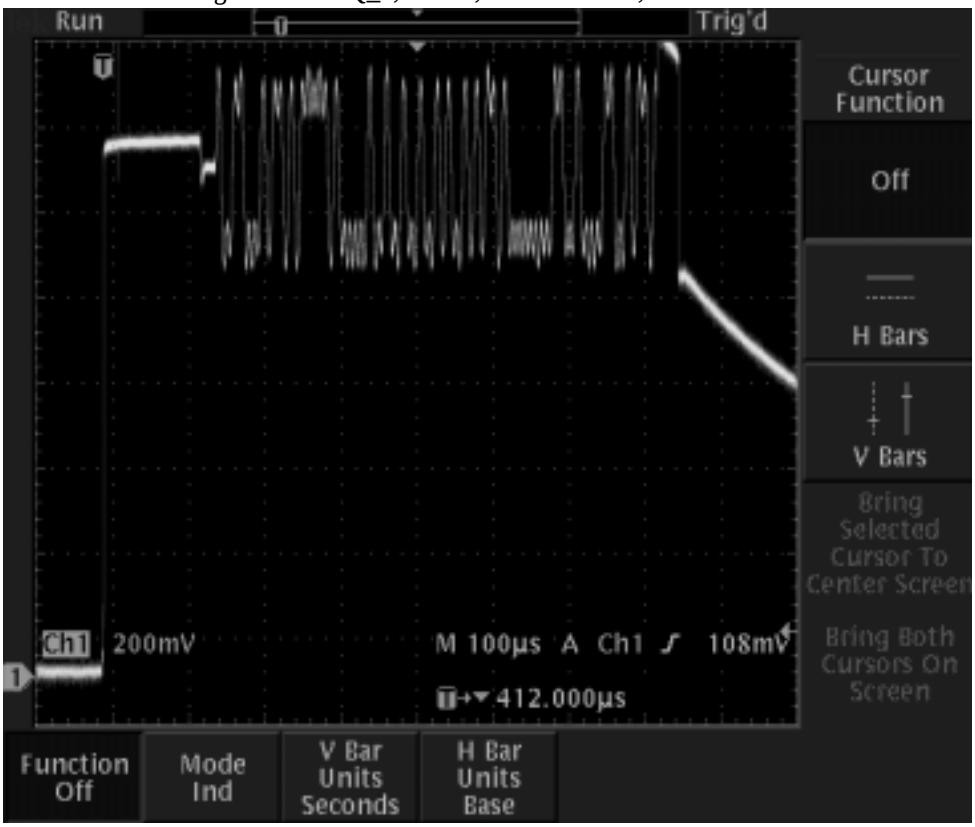

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Figure 13: 900/1800 antsw tx contr, Tx on, burst mode

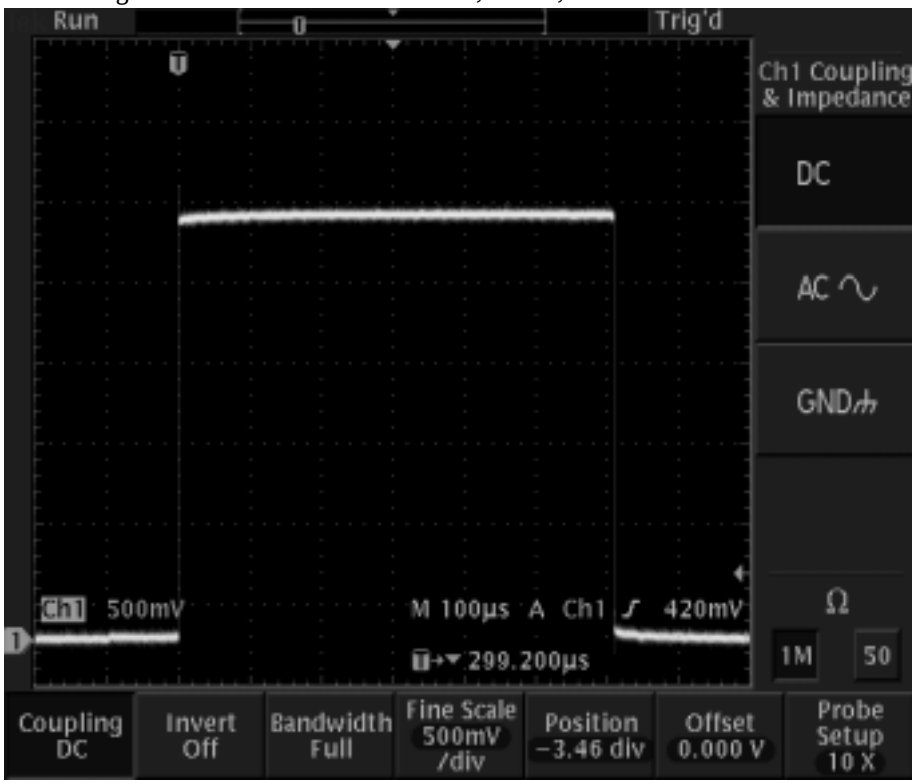

Figure 14: 900/1800 PA bias, Tx on, burst mode

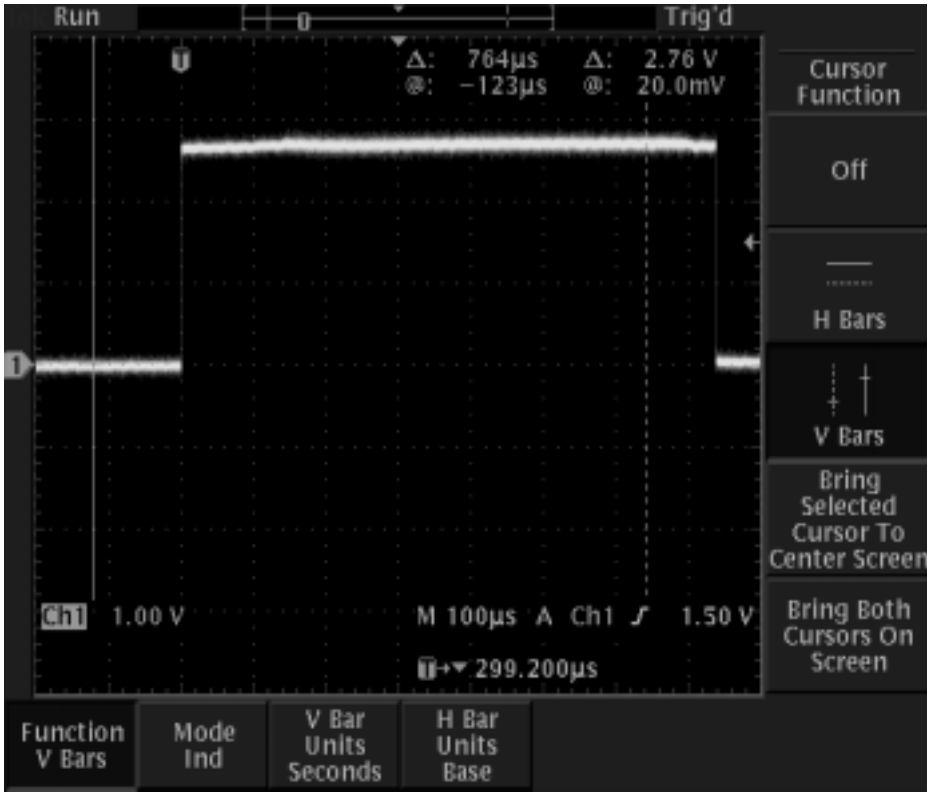

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Figure 15: 900 / 1800 PA ctrl, Tx on, burst mode, high power level

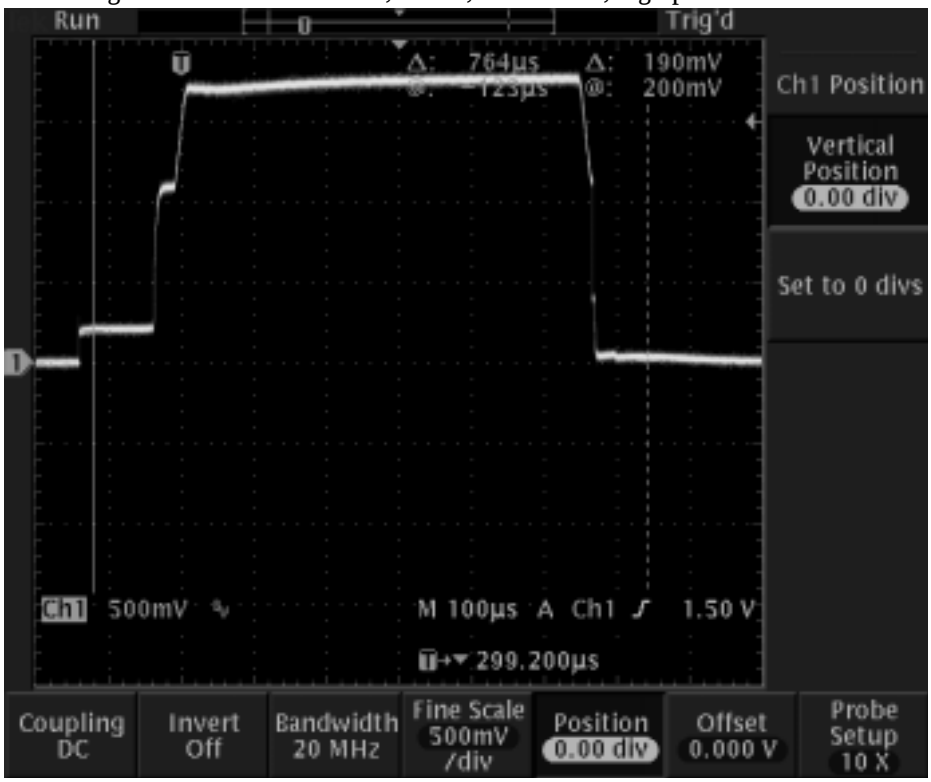
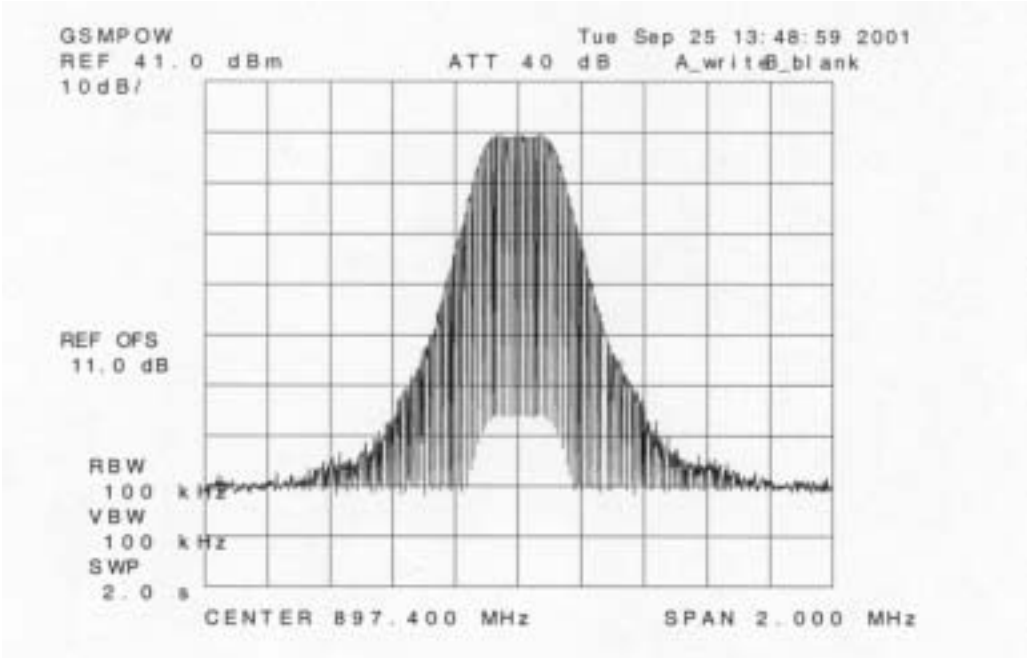


Figure 16: Tx out signal, 900 band, burst mode, channel 37



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GSM900 & GSM1800 Receiver

General instructions for Rx troubleshooting

Connect test jig to the PC with DAU9S cable or to FPS-8 Flash Prommer with XCS-4 modular cable.

Make sure that you have PKD-1 dongle connected to the PCs parallel port.

Connect DC power supply to module test jig with a suitable cable.

Set the DC supply voltage to 13.5 V.

Connect an RF-cable to the module test jig (MJS-63) RF connector and to RF signal generator.

Set the phone module to test jig and start Phoenix service software.

Initialize connection to phone. (use FBUS driver when using DAU9S and COMBOX driver when using FPS-8)

Choose product from the menu

File -> Choose product -> TME-3

From toolbar set operating mode to "Local"

Activate RF controls window from the menu

Maintenance -> Testing -> RF Controls

From the RF controls window

- Select band "GSM900" or "GSM 1800" (Default = "GSM900")

- Set Active unit to "Rx" (Default = "Rx")

- Set Operation mode to "Continuous" (Default = "Burst")

- Set AGC to "8: FEG ON + 46 dB (Default = "8: FEG ON + 46 dB")

- Set Rx/Tx channel to 37 on GSM900 band or 700 on GSM1800 band (Defaults)

Apply 942.46771 MHz (channel 37 + 67.710 kHz offset) or 1842.86771 MHz (channel 700 + 67.710 kHz offset) –90 dBm signal to the RF-connector (remember to compensate for cable attenuation).

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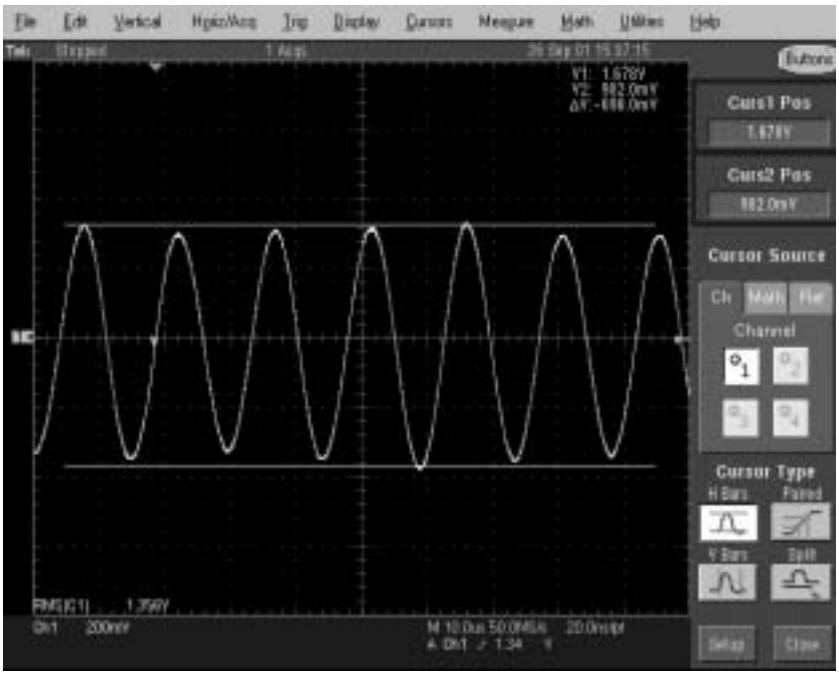
Measuring with an oscilloscope on "RX_I" or "RX_Q" this picture should be seen on a working GSM900 or GSM1800 receiver:

Figure 17: Receiver signal



Signal amplitude is 700 mVpp, DC offset 1.35 V and frequency 67 kHz. If this picture is not seen, continue to the next section.

For receiver schematics refer to the A3 size schematics at the end of the manual.

The following diagrams are used in troubleshooting the receiver.

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Figure 18: Troubleshooting diagram for GSM900 receiver

Troubleshooting diagram for GSM900 receiver

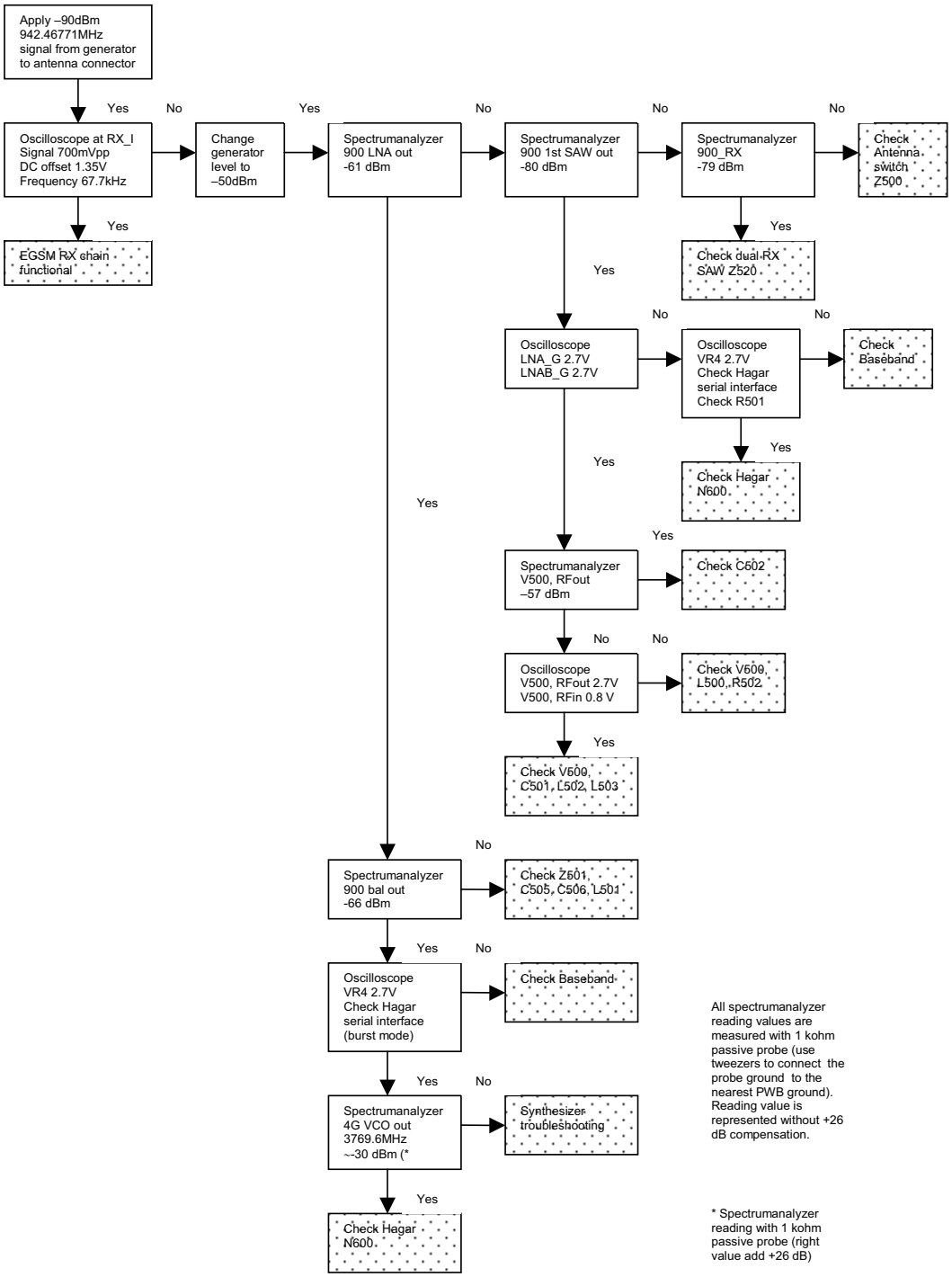
Apply –90dBm 942.46771MHz signal from generator to antenna connector
Oscilloscope at RX_I Signal 700mVpp DC offset 1.35V Frequency 67.7kHz
Change generator level to –50dBm
Spectrumanalyzer 900 LNA out -61 dBm
Spectrumanalyzer 900 1st SAW out -80 dBm
Spectrumanalyzer 900_RX -79 dBm
Check Antenna switch Z500
EGSM RX chain functional
Check dual RX SAW Z520
Oscilloscope LNA_G 2.7V LNAB_G 2.7V
Oscilloscope VR4 2.7V Check Hagar serial interface Check R501
Check Baseband
Check Hagar N600
Spectrumanalyzer V500, RFout –57 dBm
Check C502
Oscilloscope V500, RFout 2.7V V500, RFin 0.8 V
Check V600, L500, R502
Check V600, C501, L502, L503
Spectrumanalyzer 900 bal out -66 dBm
Check Z501, C505, C506, L501
Oscilloscope VR4 2.7V Check Hagar serial interface (burst mode)
Check Baseband
Spectrumanalyzer 4G VCO out 3769.6MHz ~-30 dBm (*
Synthesizer troubleshooting
Check Hagar N600
Yes
No
All spectrumanalyzer reading values are measured with 1 kohm passive probe (use tweezers to connect the probe ground to the nearest PWB ground). Reading value is represented without +26 dB compensation.
* Spectrumanalyzer reading with 1 kohm passive probe (right value add +26 dB)

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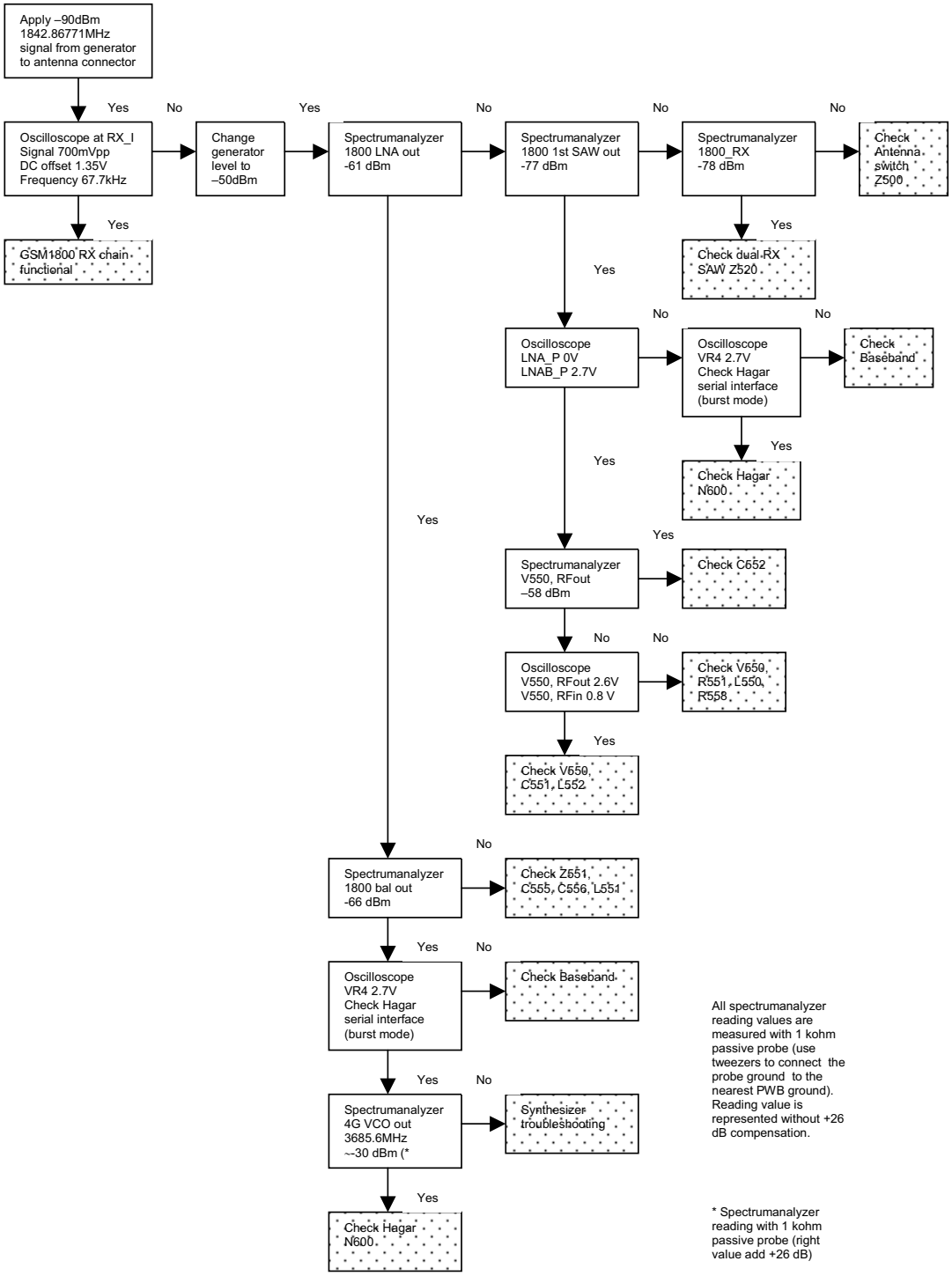
Figure 19: Troubleshooting diagram for GSM1800 receiver

Troubleshooting diagram for GSM1800 receiver


Apply –90dBm 1842.86771MHz signal from generator to antenna connector
Oscilloscope at RX_I Signal 700mVpp DC offset 1.35V Frequency 67.7kHz
Change generator level to –50dBm
Spectrumanalyzer 1800 LNA out -61 dBm
Spectrumanalyzer 1800 1st SAW out -77 dBm
Spectrumanalyzer 1800_RX -78 dBm
Check Antenna switch Z500
GSM1800 RX chain functional
Check dual RX SAW Z520
Oscilloscope LNA_P 0V LNAB_P 2.7V
Oscilloscope VR4 2.7V Check Hagar serial interface (burst mode)
Check Baseband
Check Hagar N600
Spectrumanalyzer V550, RFout –58 dBm
Check C652
Oscilloscope V550, RFout 2.6V V550, RFin 0.8 V
Check V650, R551, L550, R558
Check V650, C551, L552
Spectrumanalyzer 1800 bal out -66 dBm
Check Z551, C555, C556, L551
Oscilloscope VR4 2.7V Check Hagar serial interface (burst mode)
Check Baseband
Spectrumanalyzer 4G VCO out 3685.6MHz ~-30 dBm (*
Synthesizer troubleshooting
Check Hagar N600
Yes
No
All spectrumanalyzer reading values are measured with 1 kohm passive probe (use tweezers to connect the probe ground to the nearest PWB ground). Reading value is represented without +26 dB compensation.
* Spectrumanalyzer reading with 1 kohm passive probe (right value add +26 dB)

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LNA gainstep checking GSM900 & GSM1800

EGSM LNA out	PCN LNA out
- RF-level at antenna port e.g. –50 dBm - RX continuous mode (local mode) - difference between AGC –settings "FEG on" and "FEG off" roughly 25 dB (using 250 ohm passive RF-probe)	- RF-level at antenna port e.g. –50 dBm - RX continuous mode (local mode) - difference between AGC –settings "FEG on" and "FEG off" roughly 30 dB (using 250 ohm passive RF-probe)

LNAB_G	LNAB_P
- RX continuous mode (local mode) - 2,6 V DC voltage "FEG ON" - 0 V DC voltage "FEG OFF"	- RX continuous mode (local mode) - 2,7 V DC voltage "FEG ON" - 0 V DC voltage "FEG OFF"

LNA_G	LNA_P
- RX continuous mode (local mode) - 2,7 V DC voltage "FEG ON" and "FEG OFF"	- RX continuous mode (local mode) - 0 V DC voltage "FEG ON" - 1.9 V DC voltage "FEG OFF"

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Synthesizer

General instructions for synthesizer troubleshooting

Connect test jig to the PC with DAU-9S cable or to FPS-8 Flash Prommer with XCS-4 modular cable.

Make sure that you have PKD-1 dongle connected to the PCs parallel port.

Connect DC power supply or FPS-8 to module test jig with a suitable cable.

Set the DC supply voltage to 13.5 V.

Set the phone module to test jig and start Phoenix service software

Initialize connection to phone. (use FBUS driver when using DAU9S and COMBOX driver when using FPS-8)

Select product from the menu

File -> Choose product -> TME-3

From toolbar set operating mode to "Local"

Activate RF controls window from the menu

Maintenance -> Testing -> RF Controls

From the RF controls window

- Select band "GSM900" or "GSM 1800" (Default = "GSM900")

- Set Active unit to "Rx" (Default = "Rx")

- Set Operation mode to "Continuous" (Default = "Burst")

- Set Rx/Tx channel to 37 on GSM900 band or 700 on GSM1800 band (Defaults)

For synthesizer schematic refer to the A3 size schematics in the back of the manual

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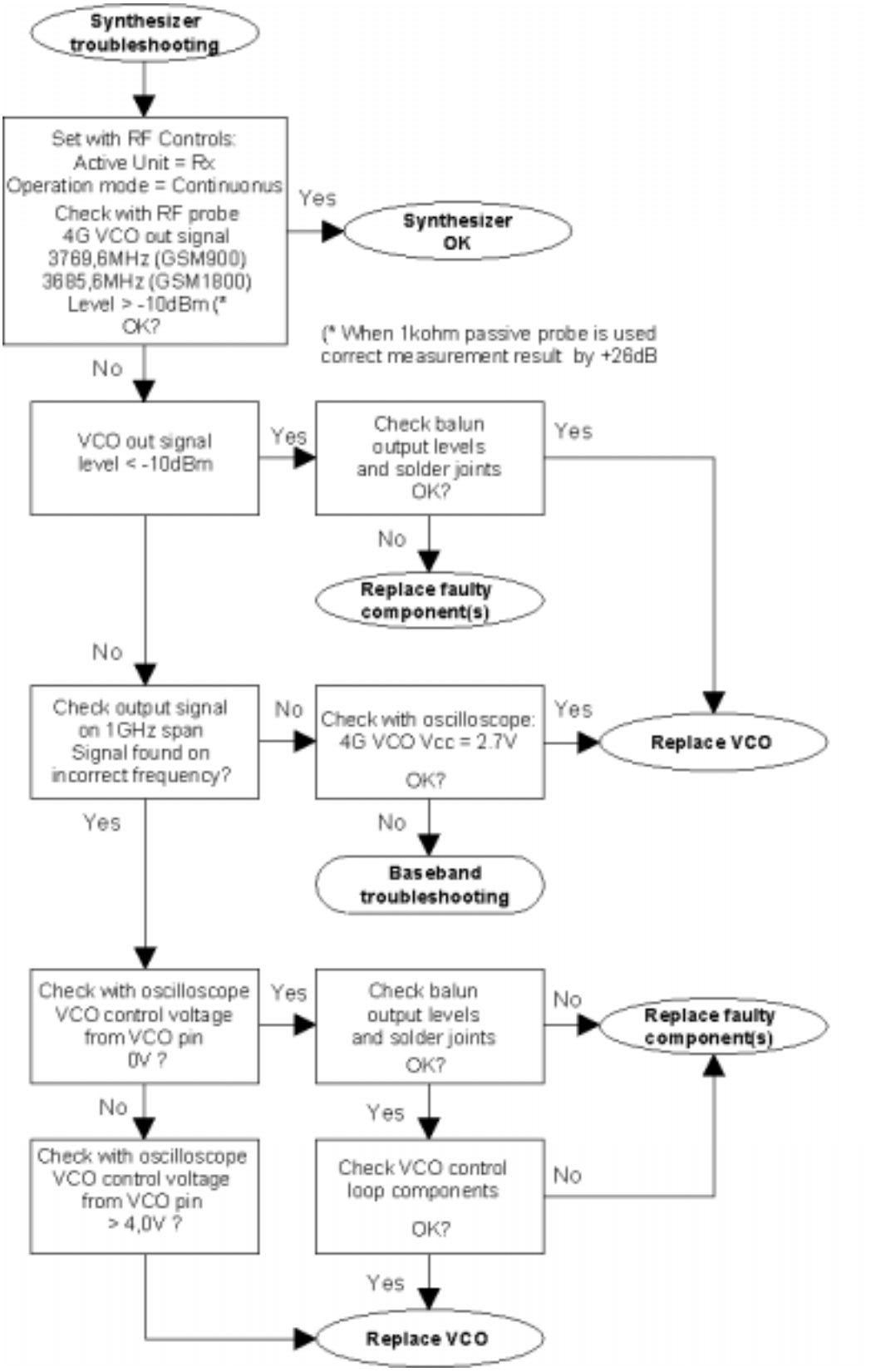
Figure 20: Synthesizer troubleshooting diagram



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Pictures of synthesizer signals

Figure 21: 26MHz XO out

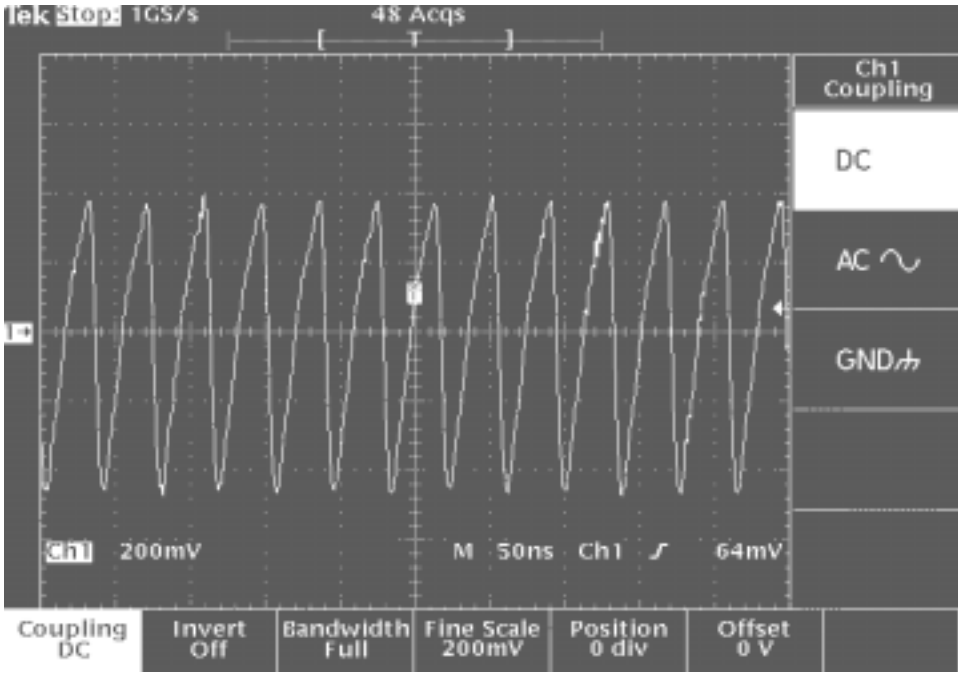

Figure 22: 13 MHz clock

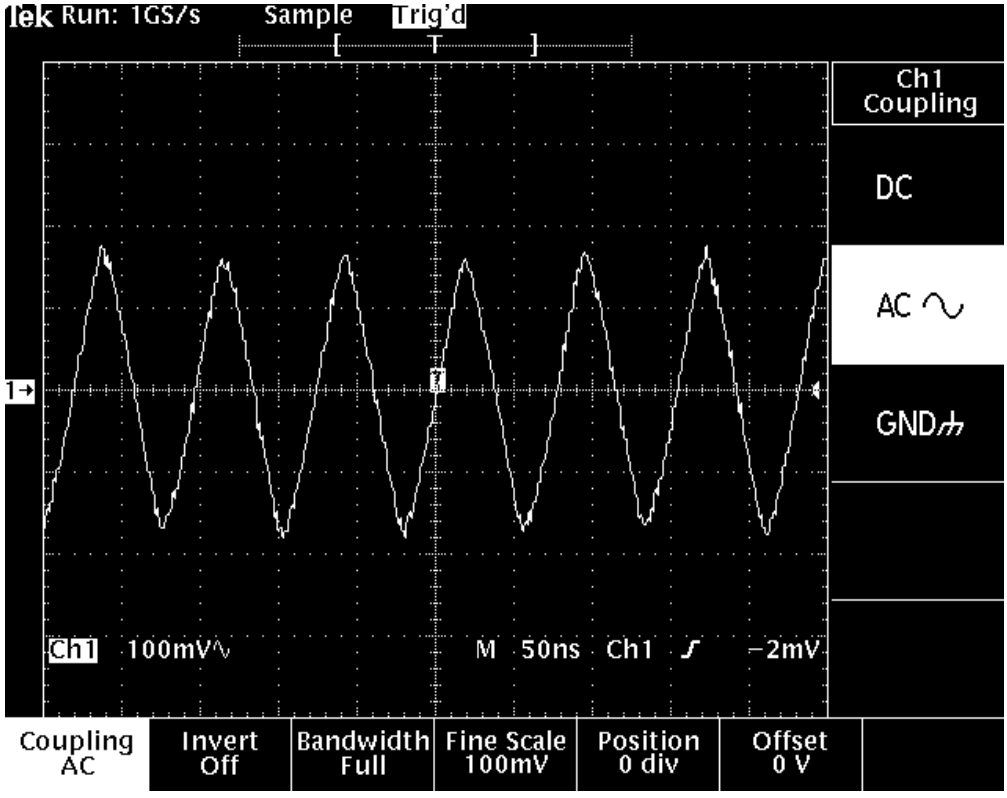

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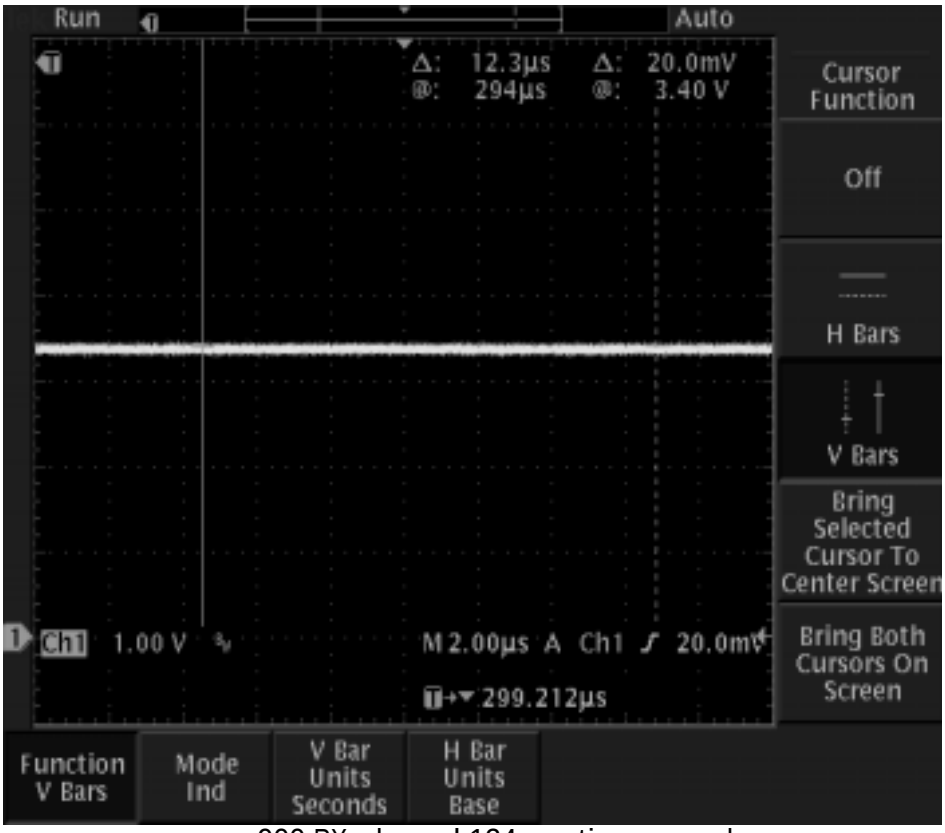
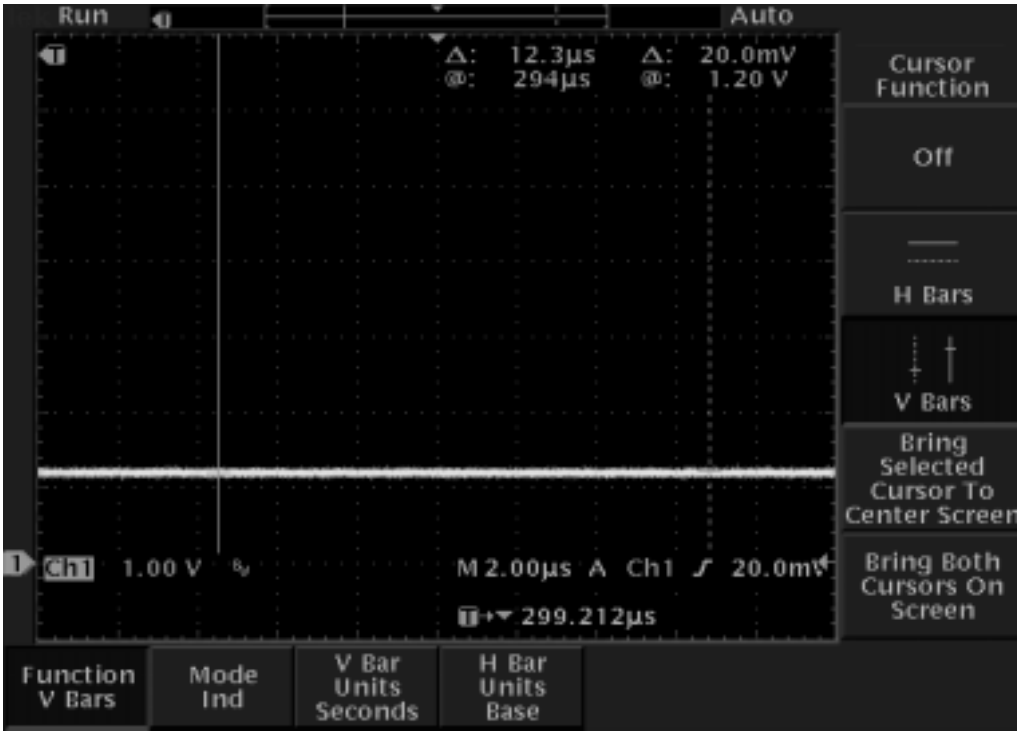
Figure 23: 4GHz VCO ctrl



900 RX, channel 124, continuous mode

Figure 24: 4GHz VCO ctrl



1800 TX, channel 512, continuous mode

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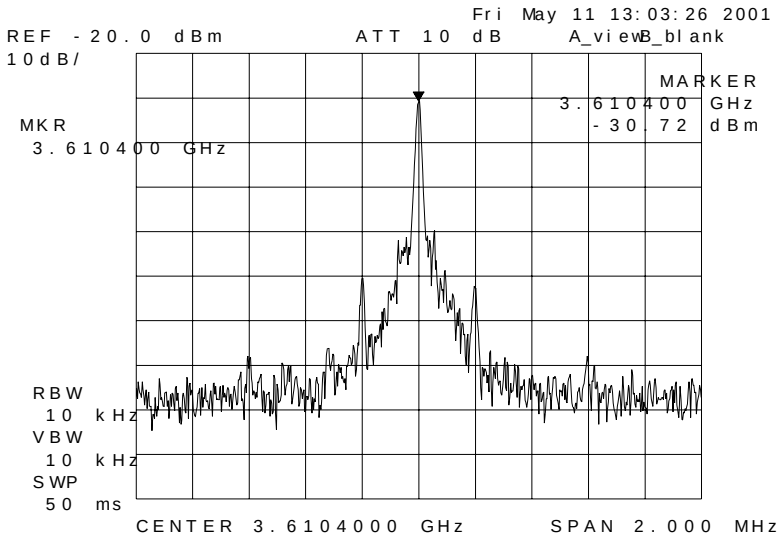
Figure 25: 4GHz VCO output, 1800 band, RX on, continuous mode



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Baseband Troubleshooting

Troubleshooting steps

The following hints help to find the problem if the baseband circuitry seems to be faulty. The instructions are divided into following sections:

1. Phone is totally dead

2. Flash programming doesn't work

3. Power doesn`t stay on or the phone is jammed

4. Plug in SIM card is out of order (insert SIM card).

6. Audio fault

The first thing to do is carry out a through visual check of the module. Ensure in particular that:

a) there are not any mechanical damages

b) soldered joints are OK

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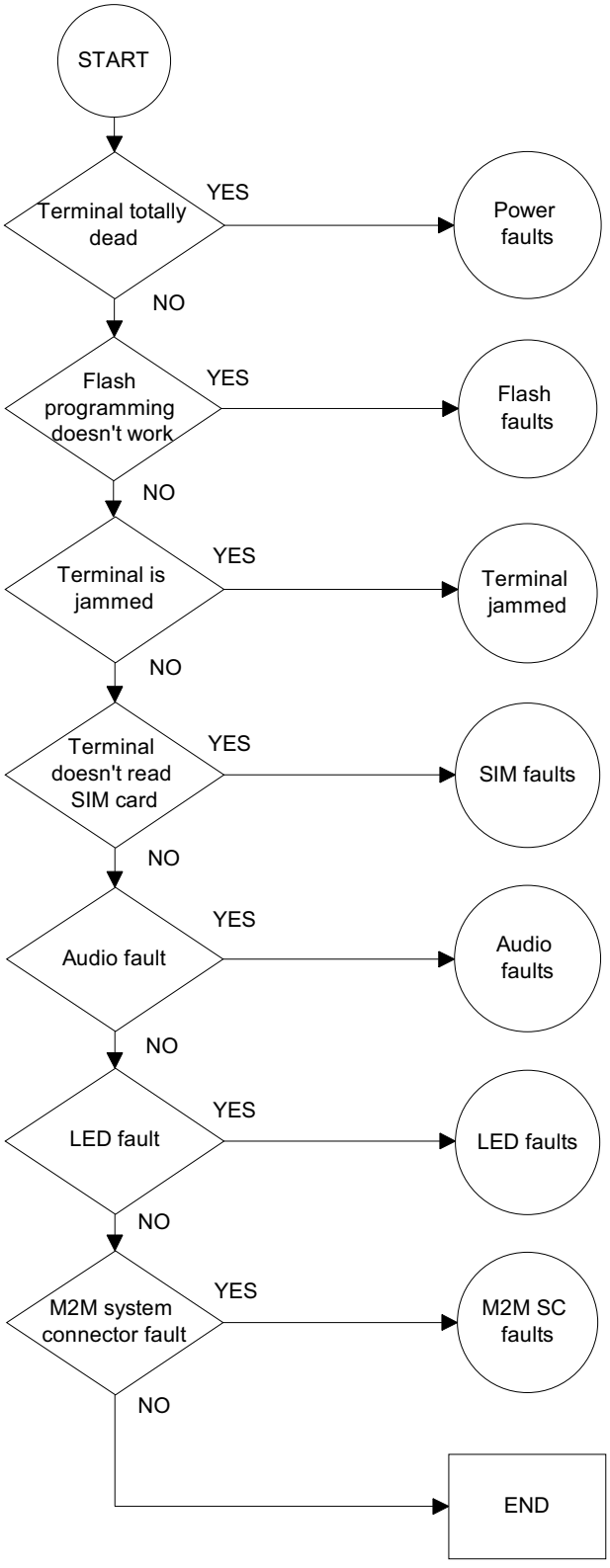
Terminal is dead (1)

Figure 26: Dead terminal, 1



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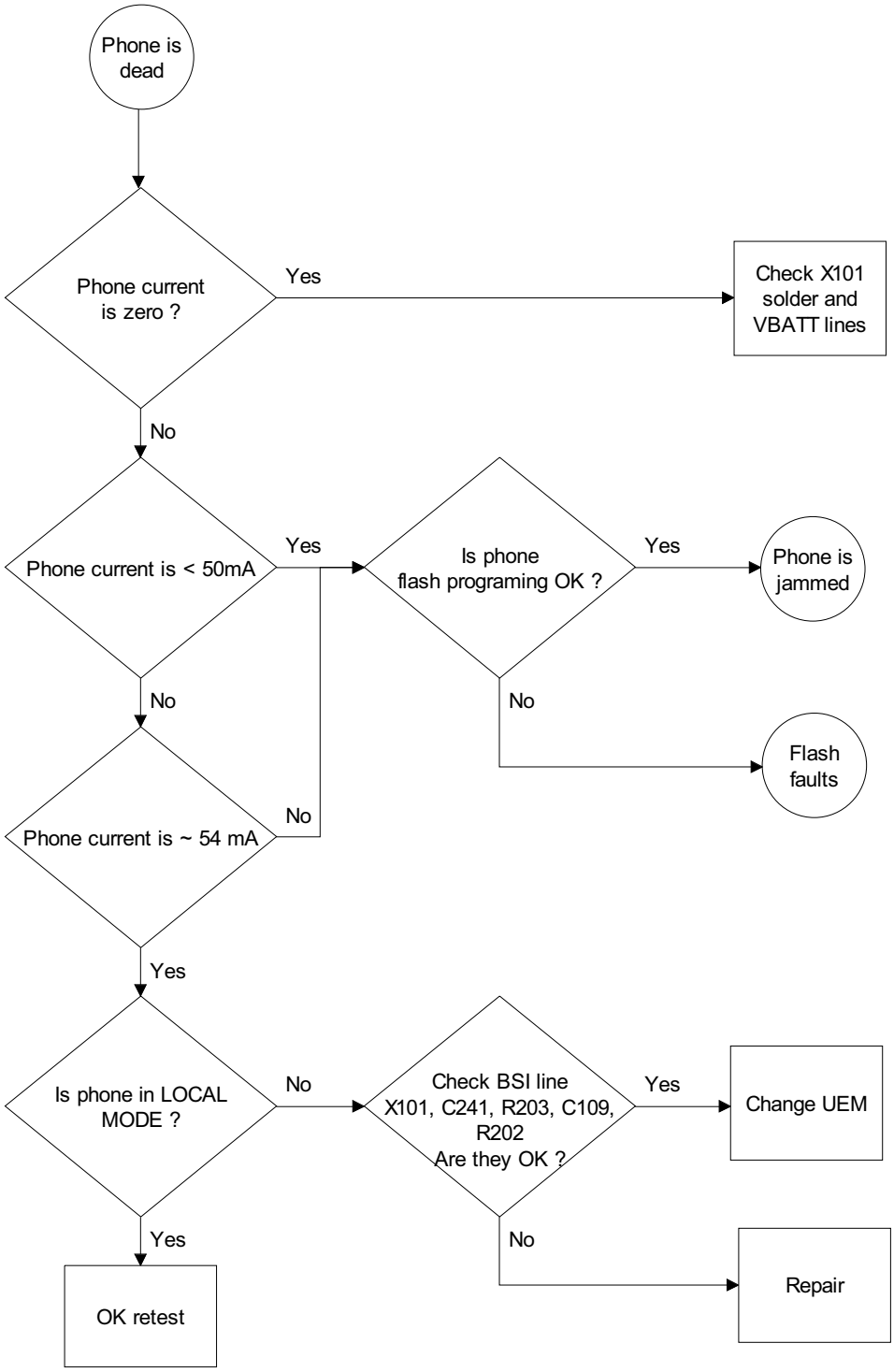
Terminal is dead (2)

Figure 27: Dead terminal



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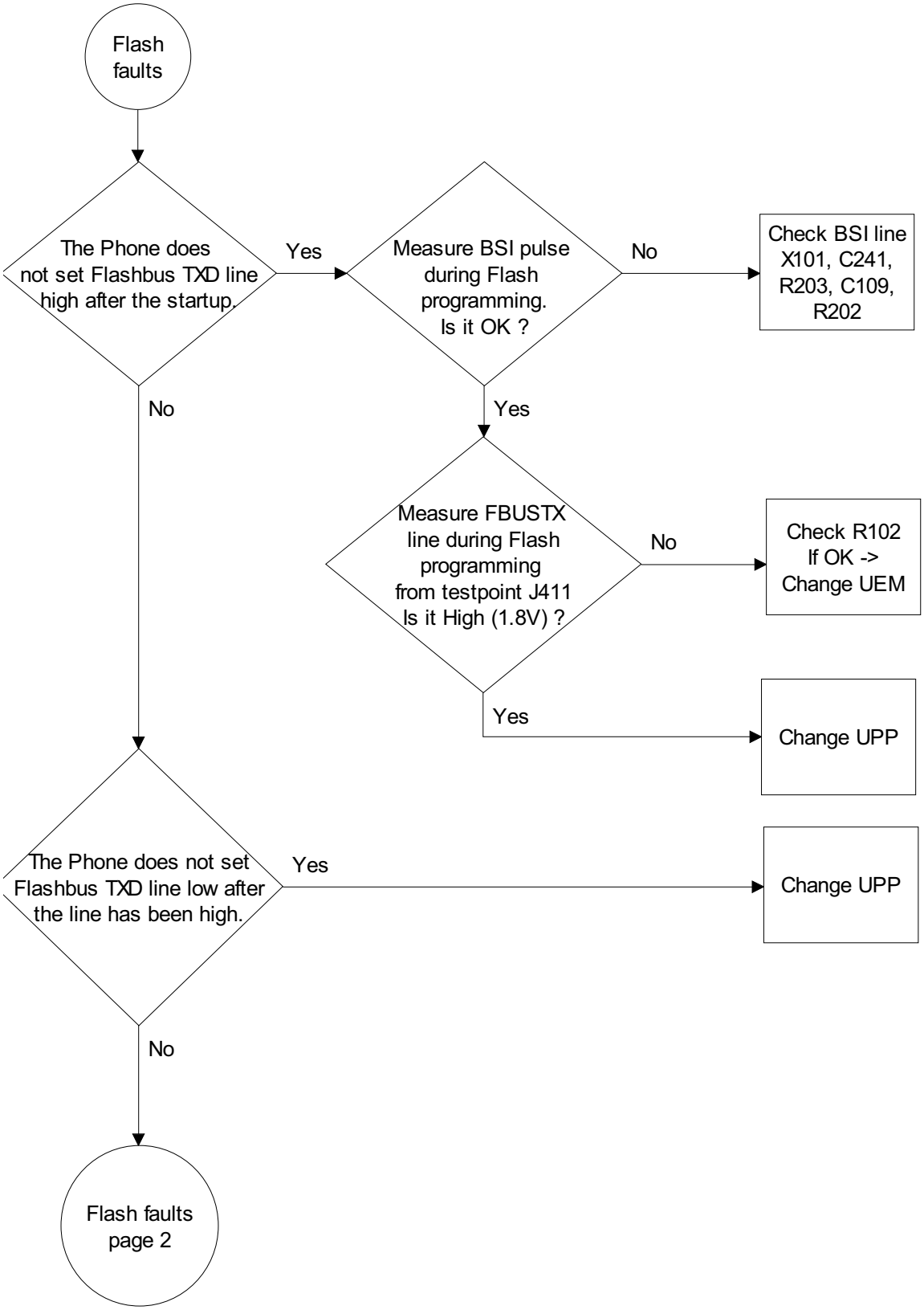
Flashing fault (1)

Figure 28: Flashing fault 1


Flash faults
The Phone does not set Flashbus TXD line high after the startup.
Yes
Measure BSI pulse during Flash programming. Is it OK ?
No
Check BSI line X101, C241, R203, C109, R202
No
Yes
Measure FBUSTX line during Flash programming from testpoint J411 Is it High (1.8V) ?
No
Check R102 If OK -> Change UEM
Yes
Change UPP
The Phone does not set Flashbus TXD line low after the line has been high.
Yes
Change UPP
No
Flash faults page 2

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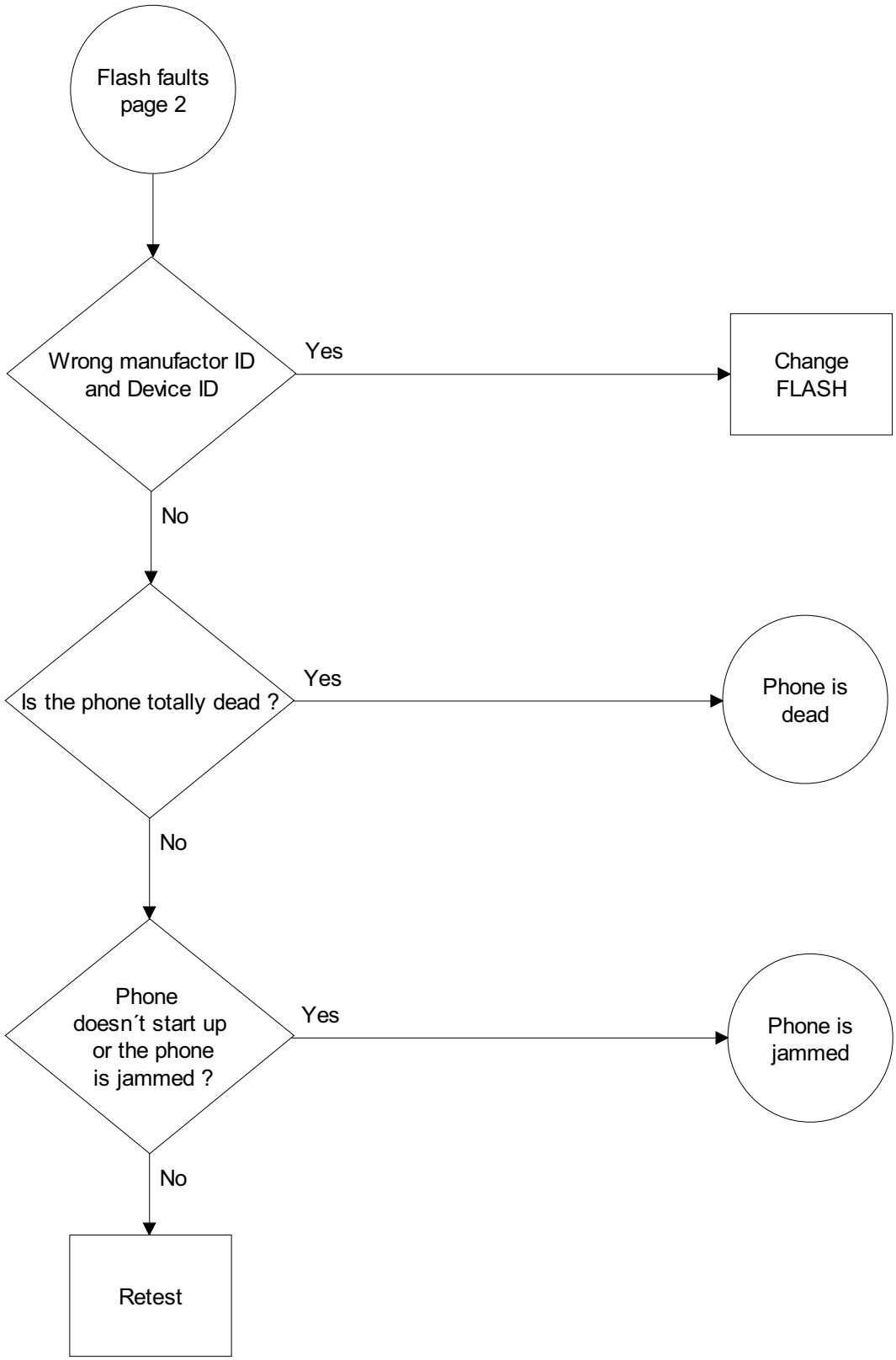
Flashing fault (2)

Figure 29: Flashing fault 2



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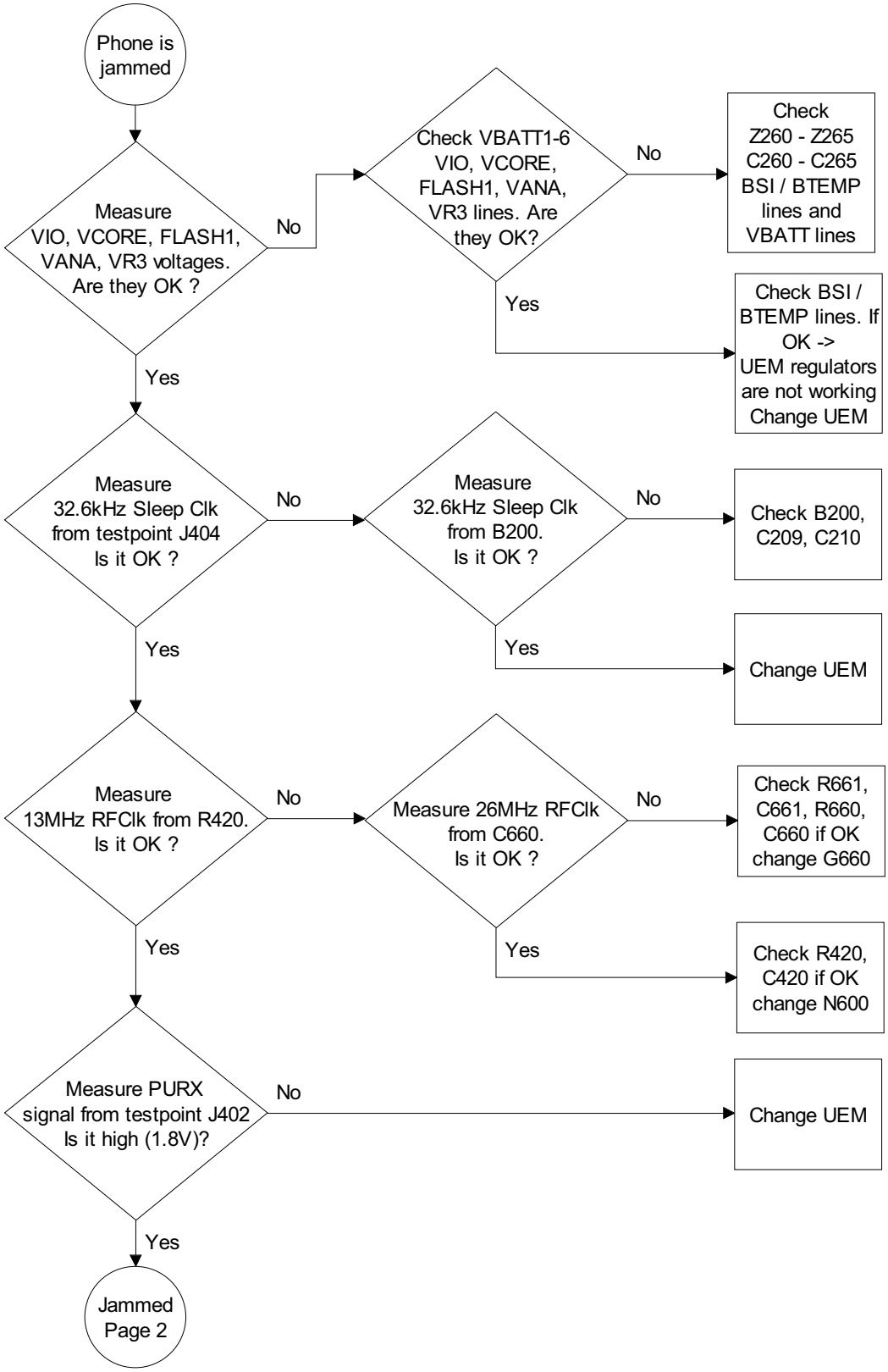
Terminal jammed (1)

Figure 30: Terminal jammed (1)


Phone is jammed
Measure VIO, VCORE, FLASH1, VANA, VR3 voltages. Are they OK ?
No
Check VBATT1-6 VIO, VCORE, FLASH1, VANA, VR3 lines. Are they OK?
No
Check Z260 - Z265 C260 - C265 BSI / BTEMP lines and VBATT lines
Yes
Check BSI / BTEMP lines. If OK -> UEM regulators are not working Change UEM
Yes
Measure 32.6kHz Sleep Clk from testpoint J404 Is it OK ?
No
Measure 32.6kHz Sleep Clk from B200. Is it OK ?
No
Check B200, C209, C210
Yes
Yes
Change UEM
Measure 13MHz RFClk from R420. Is it OK ?
No
Measure 26MHz RFClk from C660. Is it OK ?
No
Check R661, C661, R660, C660 if OK change G660
Yes
Yes
Check R420, C420 if OK change N600
Measure PURX signal from testpoint J402 Is it high (1.8V)?
No
Change UEM
Yes
Jammed Page 2

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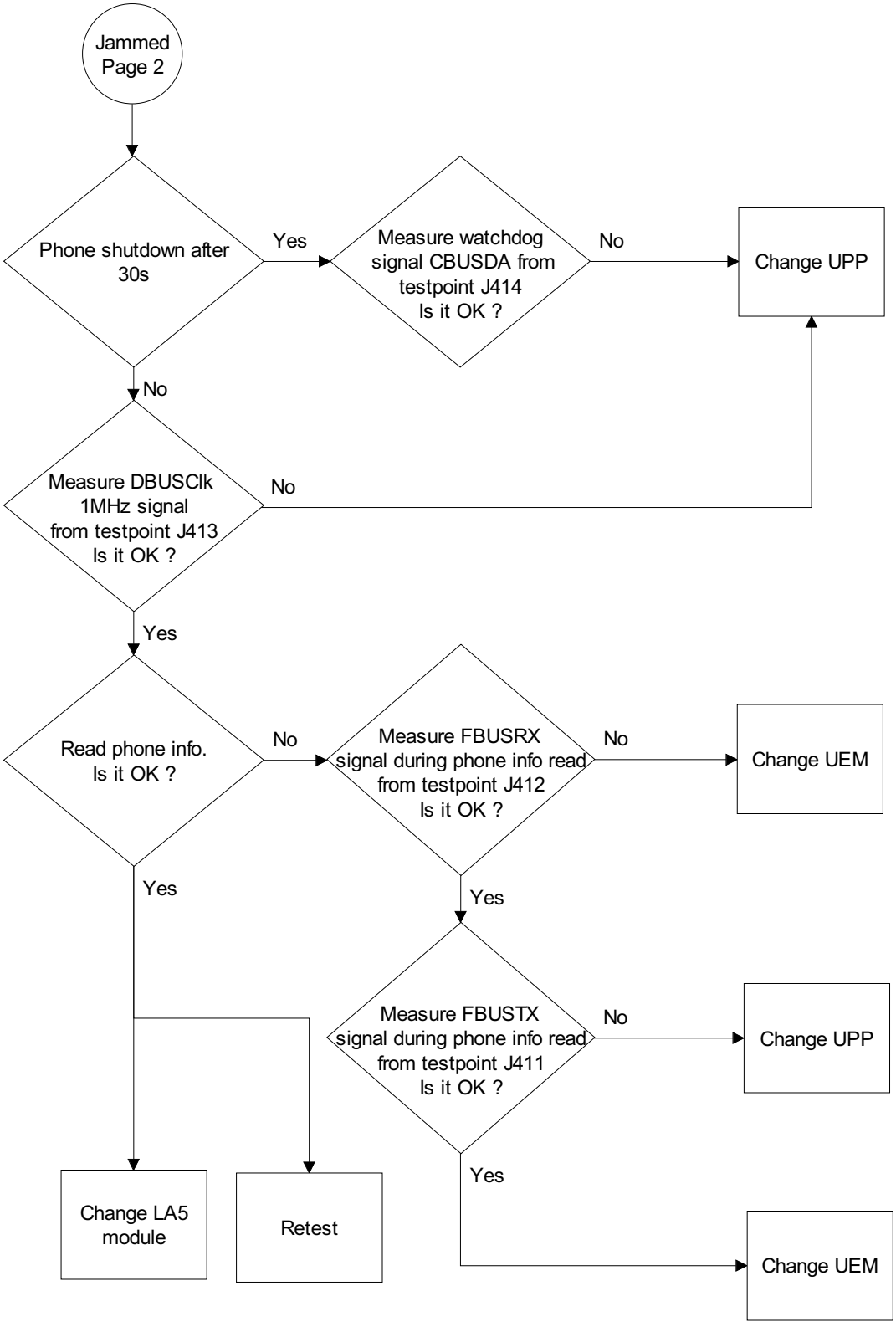
Terminal jammed (2)

Figure 31: Terminal jammed (2)



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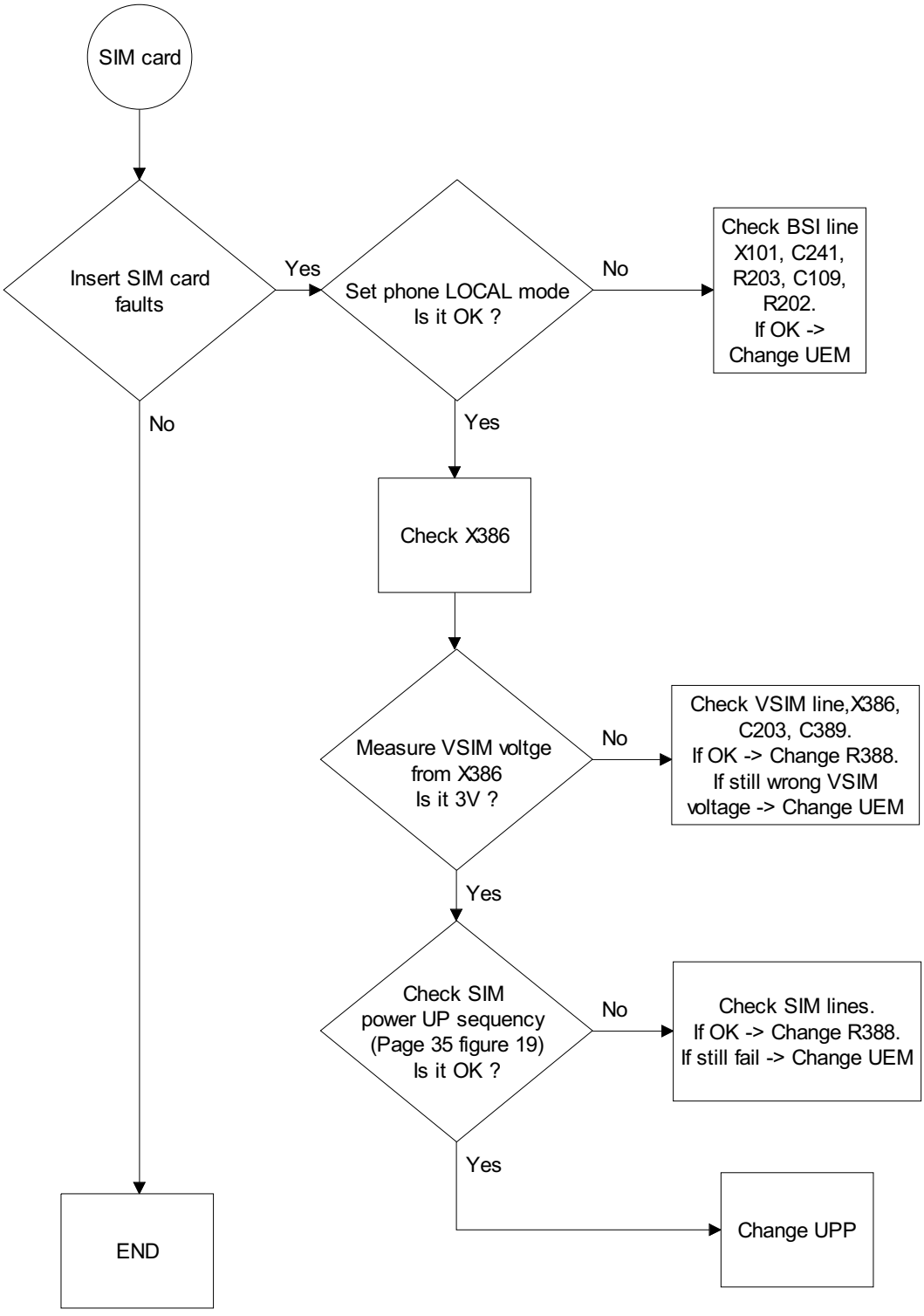
SIM card fault

Figure 32: SIM card fault


SIM card
Insert SIM card faults
Yes
Set phone LOCAL mode Is it OK ?
No
Check BSI line X101, C241, R203, C109, R202. If OK -> Change UEM
No
Yes
Check X386
Measure VSIM voltge from X386 Is it 3V ?
No
Check VSIM line,X386, C203, C389. If OK -> Change R388. If still wrong VSIM voltage -> Change UEM
Yes
Check SIM power UP sequency (Page 35 figure 19) Is it OK ?
No
Check SIM lines. If OK -> Change R388. If still fail -> Change UEM
Yes
Change UPP
END

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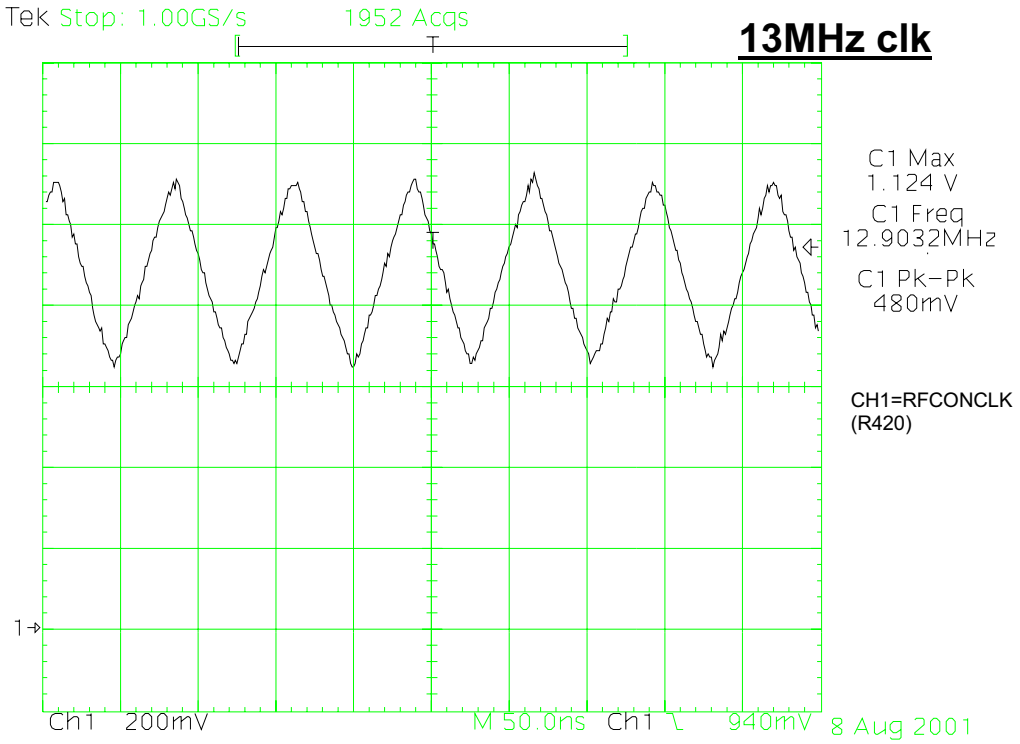
Signal diagrams

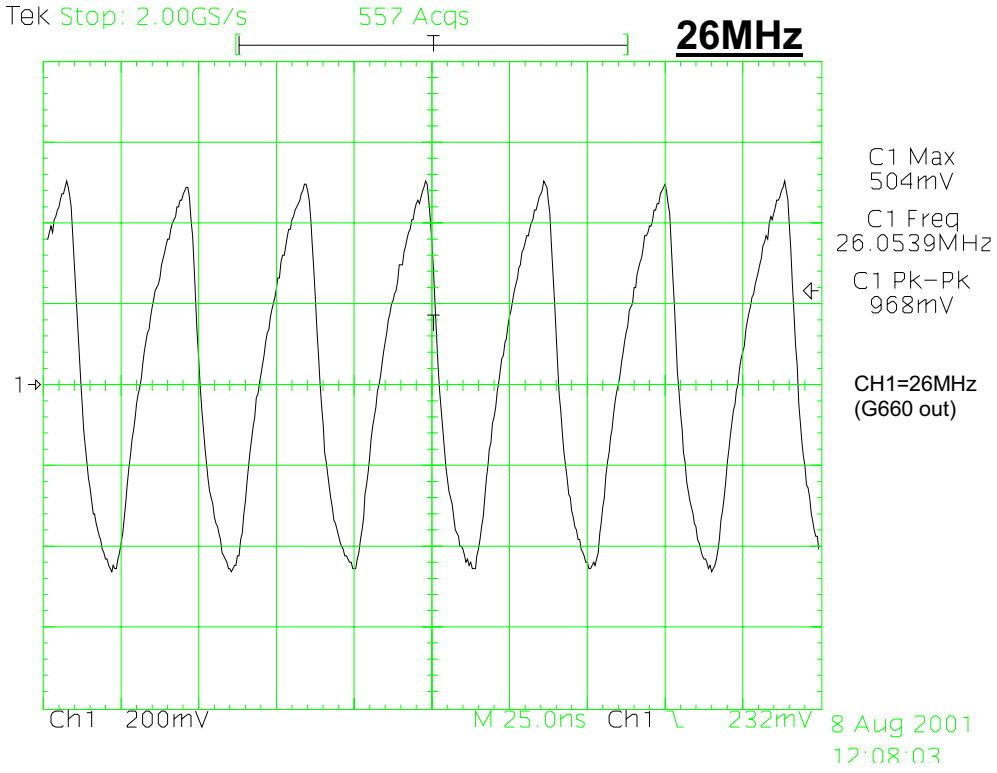
13 MHz clock

Figure 33: 13 MHz clock



26 MHz signal

Figure 34: 26 MHz signal



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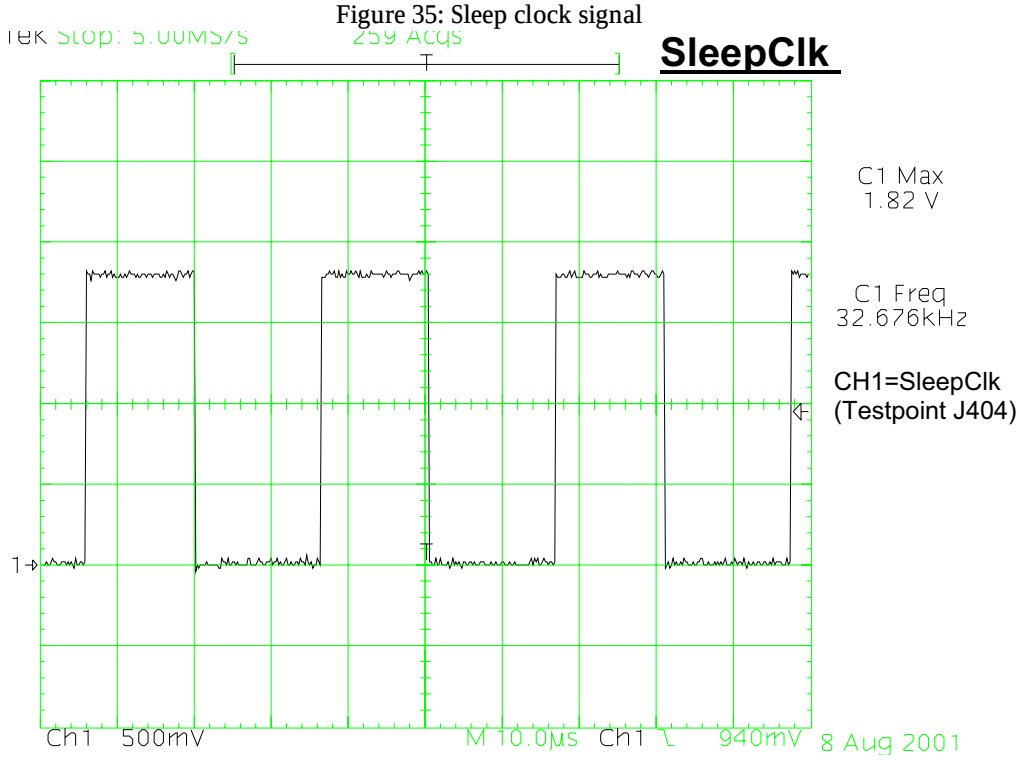
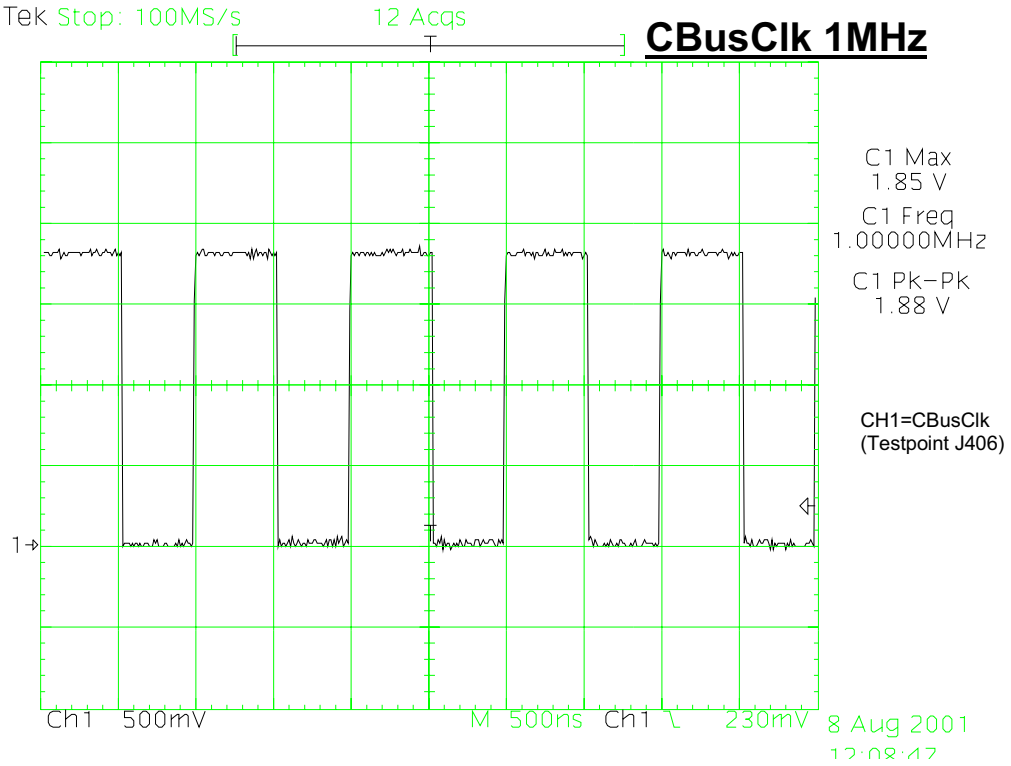
Sleep clock signal

Figure 35: Sleep clock signal



1 MHZ Cbus clock signal

Figure 36: 1 MHZ Cbus clock signal



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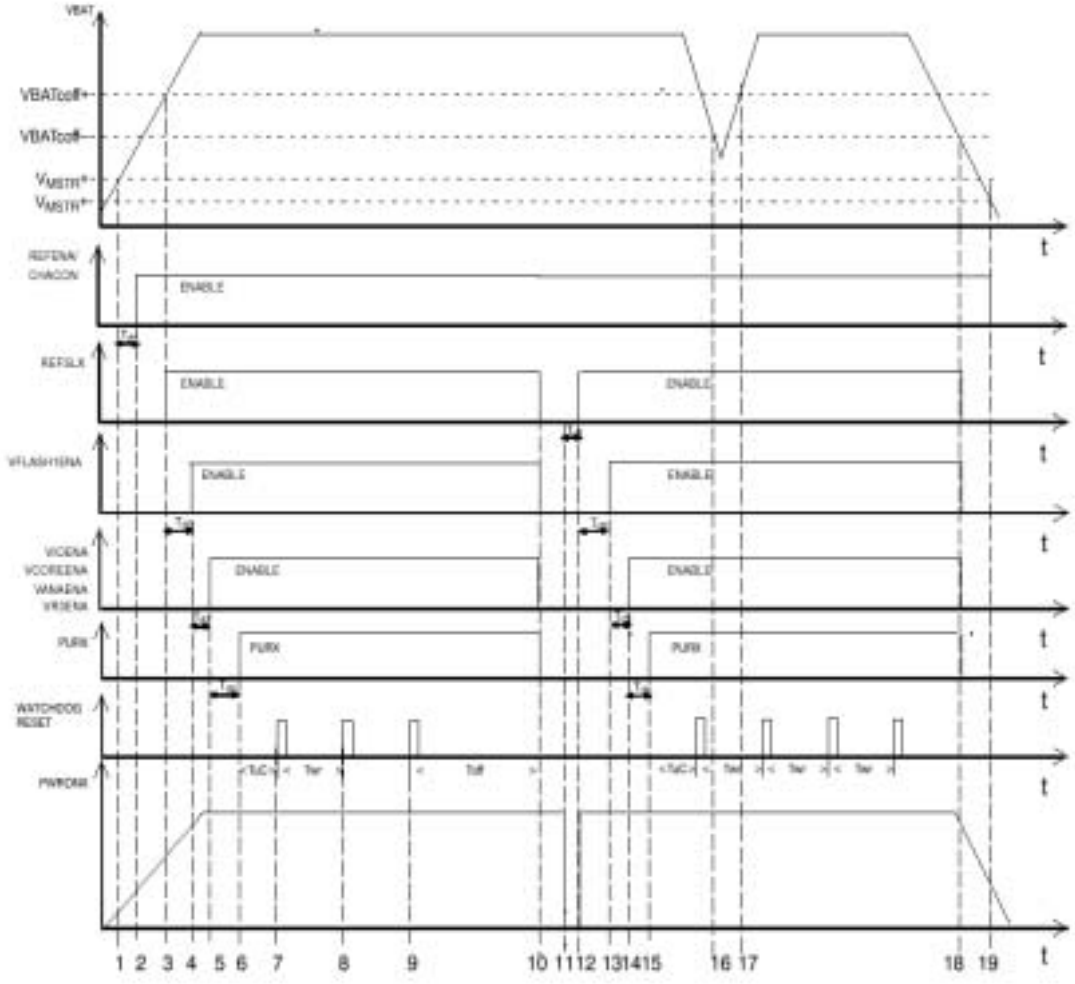
Timing diagram

Figure 37: Timing diagram



0. VBAT below V_{MSTR}. UEM in *NO_SUPPLY or BACK_UP* mode depending on the status of the back-up battery

1. VBAT appears => *VBAT > V_{MSTR+}* (master reset threshold): Bandgap, RC-osc and start-up logic starts. Time delay DELAY1 starts (T_{d1}).

2. DELAY1, 20ms, elapses. UEM in RESET mode

3. VBAT rises above *Vcoff+* threshold: Enable regulator reference buffers, time delay DELAY2 starts (200ms)

4. DELAY2 elapsed: Enable VFLASH1 regulator, DELAY3 (500us) starts

5. DELAY3 elapses: ENABLE VIO, VCORE, VANA and VR3 regulators. DELAY4 starts.

6. DELAY4 elapses: Release PURX. UEM in ACTIVE mode. RF regulators can be enabled through register writing.

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7, 8, 9 mC resets the WATCHDOG (*Twr < Toff*)

10. mC switches Power Off by letting watchdog elapse, (*Twr > Toff*). PURX low, regulators disabled.

11. Power switched on via *power switch* (low level), *VBATT > V_{COFF+}:* DELAY1 starts.

12. DELAY1 elapsed:, Enable regulator reference buffers, time delay DELAY2 starts

13. DELAY2 elapses: Enable VFLASH1 regulator. DELAY3 starts.

14. DELAY3 elapses: ENABLE VIO, VCORE, VANA and VR3 regulators. DELAY4 starts.

15. DELAY4 elapses: Release PURX. UEM in ACTIVE mode. RF regulators can be enabled through register writing.

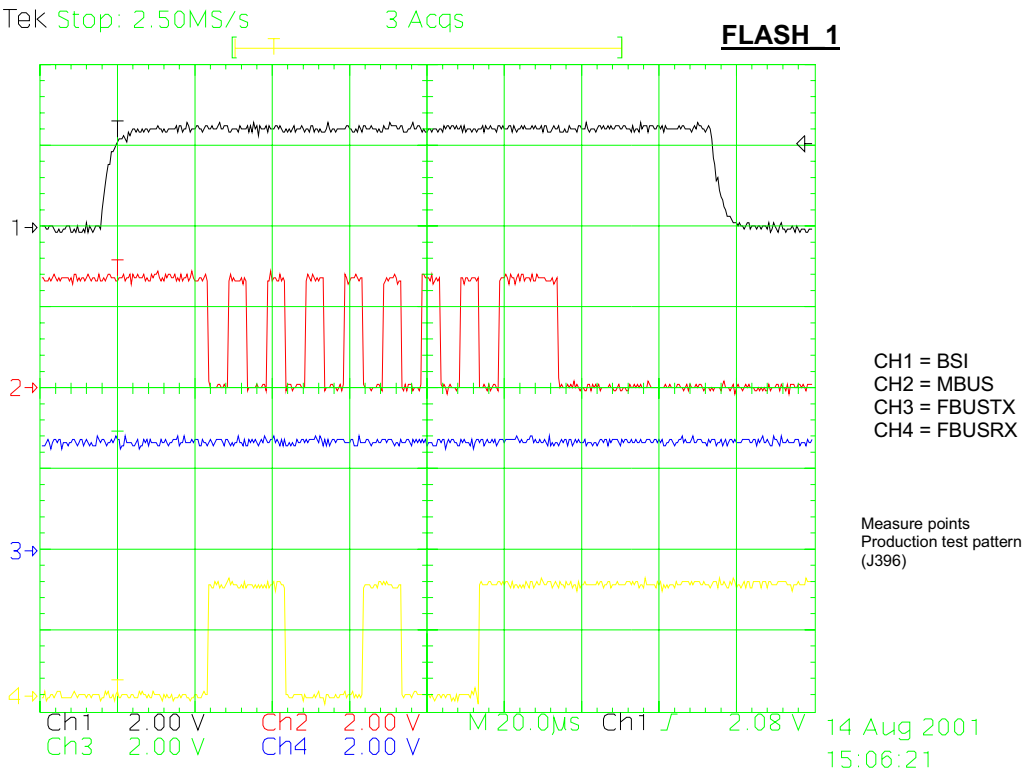
16,17. VBAT drops below reset level for a *short period (<5ms)*. Stay in ACTIVE.

18. VBAT drops below V_{COFF-} when battery discharges =>PURX low, disable regulators =>PWR_OFF

19. VBAT drops below V_{MSTR-} => NO_SUPPLY or BACK_UP mode

Flash 1 signal

Figure 38: Flash 1 signal



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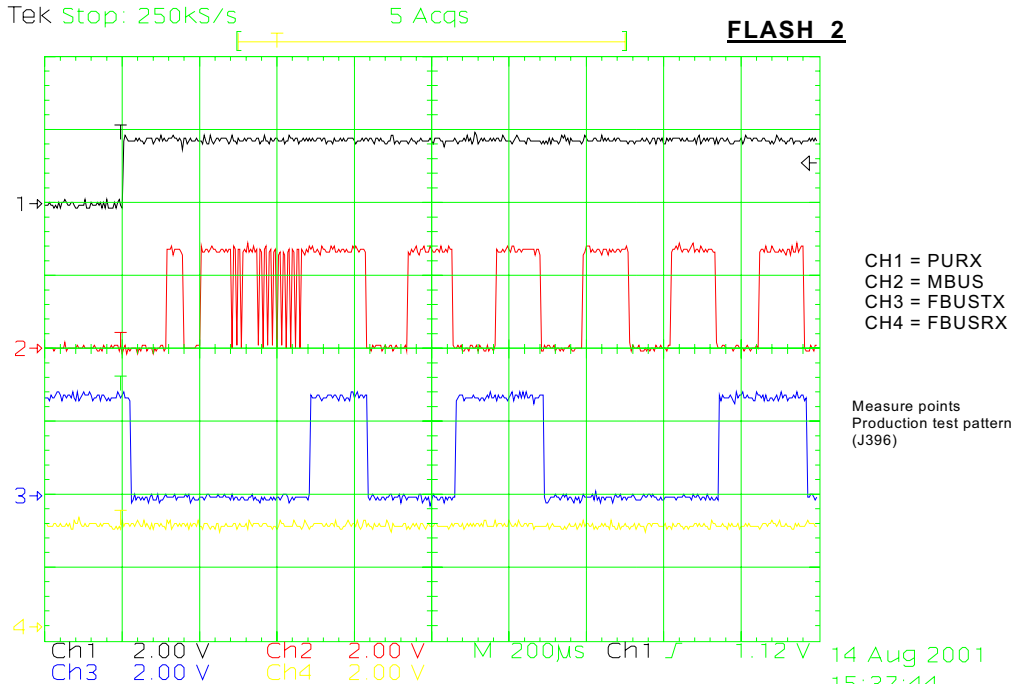
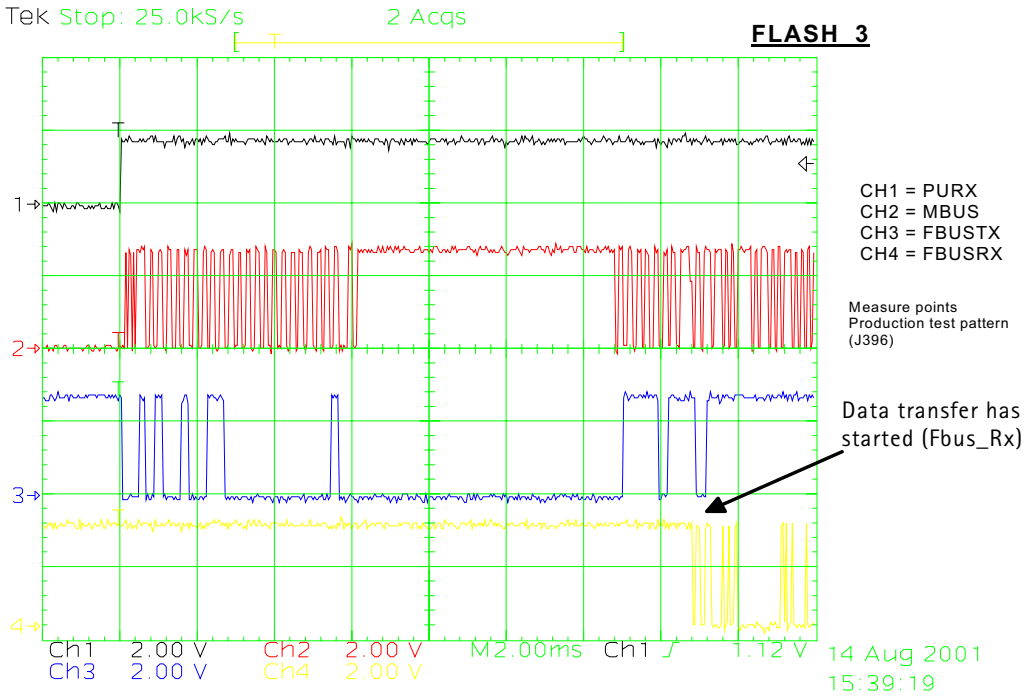
Flash 2 signal

Figure 39: Flash 2 signal



Flash 3 signal

Figure 40: Flash 3 signal



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